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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 4 SEPTEMBER, 1926 NUMBER 3

PATHOLOGY AND SURGERY OF THE EUSTACHIAN TUBE

WITH SPECIAL REFERENCE TO THE VALUE OF CLOSING IT *

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PATHOLOGY

The eustachian tube, the narrow passage through which air reaches the tympanic cavity and mastoid cells, has three distinct parts, namely, the pharyngeal, the isthmus and the tympanic. The longest, the pharyngeal, with its widely open orifice in the nasopharynx, has a cartilagenous and membranous base with muscular tissue underlying its ciliated lining mucous membrane, and is constantly dilating and closing. This part of the tube is a diverticulum from the nasopharynx, containing within its mucous membrane lymphoid tissue, and is the site of the same kinds of inflammation, infection and pathologic invasion as occurs in the nasopharynx, in which there is such an abundance of lymphoid tissue.

The outer and tympanic end of the eustachian tube is devoid of muscular tissue and action, its lining membrane is the mucoperiosteum of its underlying bony wall or base. It is a recess and a diverticulum from the tympanic cavity, projecting inward to meet the cartilaginous portion of the tube at the isthmus, this point of junction being the narrowest part of the whole canal.

The three parts together constitute the eustachian tube. It differs in length, in caliber and in direction in the child and in the adult.

While the lining mucous membrane is continuous throughout, there is an important difference in the functioning of the three sections, as has been briefly mentioned, and, as would be expected, there is a difference in the pathologic changes in these three sections.

PATHOLOGIC CHANGES

In children particularly, inflammation and infection of the lymphoid tissue within the eustachian orifice and about its posterior lip, in Rosenmueller's fossa, is a very frequent occurrence, and occasions acute tubal

* Read before the American Otological Society, Montreal, Canada, June 4, 1926.

inflammation with secondary otitis media resulting from direct extension of the infection, or through forcibly insufflating the bacteria in the act of blowing the nose.

In acute inflammation of tubotympanic catarrah, in addition to the lymphoid inflammation, the pathologic change is essentially one of passive congestion in the mucosa and submucosa.

The occlusion of the tube is partial or complete, depending on the extent of this venous stasis, together with the degree of functioning of cilia in keeping the caliber of the tube free from the exudate which pours into it. The character and virulence of the pathogenic organism is an essential factor in determining the degree of swelling and obstruction, and of the subsequent course of the otitis media. In acute inflammation, the obstruction is first at the pharyngeal orifice, chiefly from the swollen lymphoid tissue, the tube itself becoming infiltrated as in acute pharyngitis.

Adenoids, infected tonsils and acute sinusitis are active causes of acute eustachian tube infections. In scarlet fever, measles and diphtheria the eustachian tube is probably always acutely involved, as it is also in secondary syphilis. If there is not complete occlusion of the tube, the symptoms are not severe and are masked by other and more prominent ones in the throat or nose. However, the ulcerations that occur in these acute diseases may be the cause of synechiae, with subsequent obstruction and stenosis in the tube.

Repeated acute and subacute attacks lead later to a chronic hyperplastic condition of the mucous membrane, a round celled infiltration of the submucosa produced by the constant passive congestion. The mucosa is paler and thicker than normal, there is a partial or complete loss of the cilia, squamous cells replacing the ciliated, and as the disease progresses, there is a gradual deposit of scar tissue, and adhesive bands may form across the lumen; as this scar tissue increases, the lumen of the tube also increases, and from a beginning obstruction there finally results an overpatulous tube, with or without adhesive synechiae.

The commonest cause of this chronic hyperplastic inflammation is adenoids with their recurrent acute infections, particularly if they are in Rosenmueller's fossa, or in the orifice of the tube itself. Adhesions between the posterior lip and the wall of the nasopharynx interfere mechanically with the movements of the tube and form a nidus for focal infection. The constant flow of pus from an infected sinus along the lateral wall of the nasopharynx and into the orifice of the tube is a very important factor in the development of tubal pathology. Trauma of the eustachian orifice in adenoidectomy, ablation of the cartilage with subsequent scar tissue, and perhaps occlusion of the orifice itself, is by no means an infrequent cause of middle ear deafness. Complete and

permanent occlusion due to cicatrization following syphilitic ulceration in the nasopharynx is not infrequent. Chancre of the eustachian orifice, from infected instruments, was much more frequently reported in the earlier literature than of late. Carcinoma of the lateral wall, however, in Rosenmueller's fossa, occurs not infrequently, one of the earliest symptoms being stuffiness of the tube and pain referred to the ear. The disease infiltrates the orifice and the pharyngeal end of the tube. Tuberculosis is probably a much more frequent lesion in the tube, especially in children, than is generally appreciated. Logan Turner, as quoted by J. S. Fraser, finds 27 per cent of cases of chronic suppurative otitis media in children under 2 years to be tubercular, and under 1 year, 50 per cent. This is in Edinburgh, where bone tuberculosis of bovine character is much more prevalent than in this country. The tuberculous infection reaches the tympanic cavity through spreading infiltration of the mucous membrane of the tube or insufflation of infected material, or through the blood stream.

At the tympanic end, there is a different type of pathologic change than that met in the pharyngeal portion. In the former, the mucous membrane is the mucoperiosteum of the bony walls, as in the tympanic cavity and in the mastoid cells. Consequently, granulation tissue, osteitis, caries and necrosis occur here, especially about the entrance to the middle ear cavity. Perforation in the drumhead, otorrhea, often caries of the ossicles, and other bony involvement of the tympanic and mastoid cavities are associated with the pathologic changes of the tubal orifice. The original site of the disease may have begun at the pharyngeal end and have subsided there, but has persisted in the bony, tympanic end, especially if there has been a virulent type of infection, which has extended through the mucoperiosteum to the cancellous bone, or if the person has lacked resistance, or if at the time of the acute infection, drainage has been insufficient through a small perforation of the drumhead. If the infection is tubercular, caries and necrosis will continue, and a sequestrum of the bony floor may be thrown off. Granulations and polypi form around the orifice.

SURGERY OF THE EUSTACHIAN TUBE AND THE VALUE OF CLOSING IT

Surgery of the eustachian orifice is pretty much restricted to the removal of adenoid tissue in Rosenmueller's fossa, the breaking down of adhesions in the same fossa and, when required, the curettement of the lymphoid or adenoid tissue in the orifice itself. For the latter purpose a Holmes ring curet or a sharp biting forceps is used, the instrumentation being done under the guidance of the Yankauer speculum, or, using Beck's method of drawing forward the soft palate by means

of two small soft rubber uretheral catheters introduced through both sides of the nares, making the field of operation accessible to direct vision. Polyps arising in the tube can be snared or removed with forceps in the same manner. Holmes pharyngoscope is invaluable in diagnosis and useful in directing treatment. Galvanocautery of lymphoid hypertrophies in the orifice is an excellent procedure when indicated; hypertrophied lymphoid tissue in the lateral wall of the pharynx, subject to recurrent acute infections, should be removed the same as other infected adenoid and tonsillar tissue in the nasopharynx and fauces.

When closure of the tympanic orifice, following the radical mastoid operation, has failed after all other attempts, Beck advocates closing the tube through the pharyngeal orifice as a secondary operation. Briefly, his method consists in drawing forward the soft palate in the manner before mentioned, then introducing his specially devised knife into the tube beyond the isthmus, making two incisions, one on the anterior and the other on the posterior wall, extending from beyond the isthmus to the lip of the tube, then pulling out the entire mucous membrane, with a view to a complete atresia of the cartilaginous portion of the tube.

Theoretically, the eustachian tube should be closed in those cases of chronic suppurative disease of the tympanic cavity with destruction of the tympanic membrane and without mastoid involvement, in which there has been failure to arrest the discharge after all conservative measures have been employed intelligently and persistently. This conservative treatment would include not only the recognized local and topical measures, cleansing and drying methods, but such surgical procedures as removal of granulations, curettement of areas of caries and necrosis, ossiculectomy when indicated, and particular attention given to the removal of infected adenoids, in and about the tube, infected tonsils, and the curing of suppurative nasal accessory sinusitis. In this class of cases, so long as there is any chance of curing the tympanic disease without closing the tube, the latter procedure should not be attempted. If the discharging ear can be cured and remain dry, and the perforation in the drum membrane closed, then a patulous eustachian tube is certainly to be desired.

In my experience, the patients requiring closure of the tube, in which mastoid surgery is not indicated, have been few and I have never operated for this purpose, but possibly some of my patients would have been improved by operation.

In the modified radical mastoid operation, in which the ossicles and drumhead are preserved as far as possible, the eustachian tube should be left patulous, though removal, by curettement, of granulations and diseased bone about the orifice must be thorough and complete but not to the extent of bringing about atresia of the tube.

In the radical mastoid operation, the last stage prior to making the flap and applying the Thiersch graft, if one uses this method, should be completed by the curettement of the tube. The large bony cavity has been completely prepared. All bleeding should be entirely arrested and oozing stopped by epinephrine. Any cancellous infected bone or cells about the tympanic orifice, at the floor, should be carefully curetted, the bony cleft between the upper wall and the tube for the tensor tympani should be curetted and broken down, Yankauer's curet should be introduced through the isthmus and the lining wall curetted carefully but thoroughly with a view of leaving a denuded surface of bone throughout this part of the canal. Alexander's quadrilateral rasp completes the denudation. The success of this important detail in the operation—obliteration of the tube—depends on the thoroughness and care in the removal of the mucous membrane and the carious bone, and carrying the denuding of the canal wall beyond the isthmus. The chance of a closure at this narrowed portion of the tube is much greater than at the comparatively broadened orifice. After this has been finished, there remains the making of the meatal flap and the method chosen to bring about an epidermization of the cavity. Theoretically, lining the exenterated mastoid and tympanic cavity with a Thiersch graft, care being taken to cover the tubal orifice with the graft, should give an ideal result, but practically such has not been the case with most operators, and most surgeons have discontinued its use. The statistics seem to be about the same whether the graft is used or not, but this may be due to the difficulty in the technic of applying the graft in a cavity with so many angles and recesses.

I had not used grafting for a great many years, until in a recent case, in which the paraffin basket mold for applying the graft, as described in a paper by Mosher read before this Society last year, was employed. With this technic, the paraffin mold can be so made as to include the orifice of the infundibular tympanic tube, and the skin graft covering the mold inserted into it and covering the orifice securely, should, if it adheres, close the tube. This would seem to be the most advanced and best method yet devised for skin grafting in the radical mastoid cavity. Pierce has devised a very ingenious method for closure of the tube, first curetting the tympanic portion of the tube and then drawing knotted catgut attached to a bougie introduced through a catheter toward the pharyngeal orifice, inverting the mucous membrane inward in order to bring about adhesions between the denuded surfaces. Then to make doubly certain of final closure of the tube, a tongue-like portion of the meatal flap covering the exterior of the mastoid is brought down and stitched over the canal end of the tube.

AFTER-TREATMENT

The after-treatment of the radical mastoid cavity, by whatever method of lining the cavity employed, is directed toward getting a closed tube, and an epidermatized surface lining. Granulations must be controlled. Cleanliness and dryness of the wound, attending to granulations about the orifice with nitrate of silver or trichloracetic acid, are important measures. A secondary curettage may be required, as well as Beck's method of closing the pharyngeal end.

While there may be some difference of opinion and of practice among otologists regarding the desirability of closing the eustachian tube in the cases in which mastoid surgery is not done, the great preponderance of opinion, almost amounting to unanimity, favors closing the tube at the time of or following the radical mastoid operation, though there is some question as to its practicability and possibility in many cases. In this operation the drumhead is entirely removed, as are the malleus and incus, the mastoid cavity is exenterated and is made a part of one large cavity which includes the former external auditory canal and tympanic cavity. The walls of the cavity become or should become epidermatized, with no remaining mucous membrane or secreting surface. The eustachian tube ceases to have any possible function or use, and its obliteration or, at all events, its walling off from this new cavity is to be greatly desired if the purpose of the operation is to succeed. If it is not completely closed, there will continue to be tubal infection with more or less mucus and pathogenic mucopurulent discharge blown out of the tube into the mastoid cavity, especially with each recurrent cold in the head; this discharge causes a soggy condition of the new epidermis about the tubal tympanic orifice and tends to produce granulations, with the result that a more or less constant moisture and otorrhea continues, from which the patient expected to be relieved by the serious operation.

Failure to close the tube in the radical mastoid operation means, on the part of the patient, failure of the operation and discredit of the surgeon. Few patients, other than the more intelligent, would submit to the radical mastoid operation, if it were not for the expectation and hope of getting rid of the malodorous, long continuing otorrhea.

If the hearing of the opposite ear is fairly good, he is little concerned regarding the deafness of the discharging one. Vertigo, headache, focal infection, threatened labyrinthitis and intracranial disease are conditions and possibilities less disturbing tc him than the odorous discharge, perhaps because he fails to appreciate the danger. To the otologist the discharge may be the least important symptom; to the patient it is the all engrossing one, and the one which leads him to seek relief and submit to this operation.

Having regard for the point of view of the patient, and for the reputation of the surgeon, and the desirability of bringing about a genuinely successful result, no effort should be spared to discharge the patient not only with as good hearing as possible, but with a dry ear which will stay dry. Explanations as to why this result may not be finally accomplished should be made prior to the operation rather than after, a matter which all of us are prone to forget till the explanation seems called for.

COMMENT

Probably 50 per cent of all radical mastoid operations, regardless of the technic employed, are unsuccessful so far as leaving a perfectly dry ear is concerned, and yet probably 95 per cent of the operations are highly successful so far as relieving the patient of the much more important symptoms and conditions, present or threatening.

There are other causes of failure to procure a dry cavity than those of the surgical technic employed in the operation or in the local after care. Mucoperiosteum may be left, carious bone may not all be seen and removed, no matter how painstaking the operator, scabbing crusts will form on the epidermatized surface of the wound, though the tube be sealed. Undernourishment, environment, diabetes, tuberculosis, syphilis, lack of sunlight and outdoor living are some of the general conditions that prevent healing of the bone and cicatrization of the tube with its closure, and which should not be disregarded in the treatment. Regardless, however, of the character of the operation and the method of epidermatizing the cavity and the kind of flap used, there are a certain percentage of cases, too many for comfort, which will defy our best efforts to bring about a result satisfactory alike to the patient and to the otologist.

LOCAL TREATMENT OF THE EUSTACHIAN TUBE

WITH SPECIAL REFERENCE TO THE PRESENT STATUS OF THE BOUGIE *

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NEW YORK

Reviewing casually my practice for the past thirty years, I am struck with the fact that an overwhelmingly large percentage of patients who consult an otologist do so because of impaired hearing. A small percentage seek advice for conditions in which the surgical menace has, temporarily at least, placed the consideration of the impaired function in the background. Experience taught me early that one could only hope for increasing numbers of the more stimulating surgical cases by evincing a genuine interest in the more drab conditions, in which patients sought improvement for their impaired hearing.

Patients with impaired hearing—leaving out the suppurative cases—must be segregated into different classes; they could not all be subjected to the same treatment with any hope of even partial improvement. In a general way, these subjects could be divided into those in whom the impaired hearing was due to lesions of the conducting apparatus and those with lesions of the receiving apparatus. Treatment by local measures in the latter was obviously useless.

LOCAL TREATMENT

It was gradually borne in on me that of the remaining patients—those in whom the impaired hearing resulted from lesions of the conducting apparatus—in whom a spongification of the labyrinthine capsule was responsible for the impairment—were in no way influenced by local treatment unless there was, in addition, a concomitant catarrhal process in the middle ear. The field in which local measures could be expected to be serviceable, therefore, was limited to the so-called catarrhal types. Continued experience demonstrated quite clearly that of the latter cases very little lasting benefit could be expected from the various treatments which from time to time had come into vogue. I refer to the apparatus designed for vibratory massage; local massage of the drum through the canal; electrical treatments with galvanic or other form of electric current; the ultraviolet ray, the roentgen ray, etc.

THE EUSTACHIAN TUBE

The last analysis reduces the matter to the conclusion that results which are satisfying in any degree come from attacking the condition

* Read before the American Otological Society, Montreal, Can., June 3, 1926.

through the ventilating mechanism of the middle ear—the eustachian tube. In all these subjects, the impaired hearing primarily starts from interference with the normal balance of the external atmosphere and that of the middle ear. For perfect hearing it is necessary that the air shall be changed by each act of deglutition so that the pressure on both sides of the drum membrane may be kept practically equal.

It should be borne in mind that, while it is important that the tube should be sufficiently patent to preserve this normal pressure balance, it is also essential that the change of air be accomplished instantaneously by the act of swallowing. The function of hearing in the perfect ear takes place with a closed tube. A constantly open tube, if it could be made, would probably produce no better hearing than would be present with a perforated drum. The air pressure balance must be maintained in a closed tympanum.

The mechanism accomplishes for the act of hearing, the maintenance of a perfectly balanced air-cushion at all varying levels—on the seashore or on the mountain; down in the cellar or up in the garret. The mechanism instantaneously equalizes the varying pressures, and maintains a closed tympanum at that pressure to transmit the sound-waves to the cochlea.

Constant swallowing is essential to perfect hearing just as winking the eyelids is essential to perfect vision. The act of winking temporarily cuts off vision. It takes place so quickly that the interference is not noticed. In the meantime, it has accomplished its purpose of lubricating the conjunctiva and thus has aided vision.

The swallowing act and the winking act are analogous; they aid an important function by a mechanical act. One lubricates the eye, the other ventilates the ear. The eyelid closes to lubricate the conjunctiva and opens in order that the eye may see clearly. The eustachian tube opens to ventilate the tympanum and closes in order that the ear may hear clearly.

The mechanical act by which the change is made in each instance is so instantaneous that the temporary interference with function is unnoticed. How essential they both are to the respective functions they aid may be determined by refraining from winking or swallowing for a minute or two. It is like the regulator to the watch; the carburetor to the gasoline engine; they do not run smoothly and accurately without the delicate adjustment.

If one could conceive a mechanism which would constantly bathe the conjunctiva with a physiologic sodium chloride solution, the eyelids would not be essential to perfect sight. If one could conceive a mechanism which might maintain a constantly varying pressure in the tympanum without constant change of air, the eustachian tube might be dispensed with as an aid to hearing.

I am saying these things less scientifically, possibly more practically, certainly more simply, just to bring out the important point of why the otologist ever enters into the picture.

As the lower register of tone perception is the one which is largely impaired by interference of this function of the eustachian tube, alterations in the caliber of the tube go hand in hand with that part of the hearing function which is most important in the pursuit of our daily avocation.

CAUSE OF OBSTRUCTION

When obstruction of this mechanism occurs, what is the cause?

We may say at the outset that in the course of a lifetime one encounters few cases of actual fibrous stricture of the tube and these are traumatic from instrumentation or from operation; from the application of caustics or from suppurative inflammatory scars; from syphilis or from diphtheritic ulceration, in which case the fibrous constriction is at the pharyngeal opening.

The large percentage of tubal obstructions, either mild or severe, occurs as a catarrhal swelling of the submucous layers of areolar tissue. It must be borne in mind that this takes place, not only in the tube, but throughout the tympanum as well. In the mild and early cases, this amounts to a mere tubotympanic congestion. This congestion may be active when inflammatory processes have brought it about, or passive when mechanical interference with proper ventilation and drainage have been responsible. In either case, when this congestion is prolonged, hyperplastic thickening occurs.

The eustachian tube must be thought of as a double trumpet-shaped tube, supported by muscle and cartilage in its closed part from the throat to the isthmus, and supported by bone in the open part from the isthmus to the tympanum, lined throughout with epithelium having a submucous layer of areolar tissue. With a congestive swelling or an hyperplastic thickening of this layer throughout, it is easy to conceive how, at the narrower portion of the tube—at the isthmus and just beyond—a very definite constriction might be effected. Such obstructions interfere with the rapid and efficient change of air in the tympanum of which I have spoken; and this, together with the accompanying impaired mobility of the drum membrane and ossicular chain from the swollen or thickened epithelial covering, mechanically causes the impaired hearing.

RELIEF OF OBSTRUCTIONS

The relief of such conditions can be accomplished only by local measures. When obstructing hypertrophic lymphoid tissue or mechanical impediment from nasal or nasopharyngeal obstruction is responsible, they must, of necessity, be removed as a prerequisite to further treat-

ment. When tubal swelling is being brought about by disease of adjacent tissues—in the nose, nasal accessory sinuses, nasopharynx, or pharynx—these must, so far as possible, be eradicated before one can expect any measure directed to the tube itself to be of lasting benefit.

There remains the consideration of what can be done directly to the tube itself, in which impairment continues despite the correction of these underlying causes. In the earlier cases, inflations by means of a eustachian catheter—using twelve to twenty puffs of air, regulating the pressure by the patency of the tube as indicated by an auscultation tube, and followed by a few puffs of a vapor of camphor menthol and iodine through a Dench inflator—often entirely relieve the symptoms after a few treatments. One or two weeks' duration has been my experience with acute tubal catarrh.

Subacute and chronic cases are merely a continuation of the acute, with gradually increasing changes in the mucous lining as I have briefly outlined, resulting from the long continued swelling. Inflation of such cases usually effect a temporary brilliant improvement in hearing which, depending on its severity, slumps back in from a few minutes to a few days. In such cases only do I believe in the use of the bougie.

It is to the intelligent and skilful use of bougies in such cases, however, that the most satisfying results in impaired hearing—satisfying both to patient and to surgeon—are obtained. And when I say skilful and intelligent, I wish to qualify the statement by the observation that, in the most skilful and intelligent hands, the application of the eustachian bougie can hardly be more accurate in its application or intelligent in its manipulation than would be the equivalent of taking one's Patek-Philippe watch to a Waterbury factory for regulation.

It is not in the nature of things that as perfect an apparatus as the eustachian tube can receive the ruffianly insult which the gentle insertion of a bougie would represent without resenting it. It is only in the cases in which the tube is disfunctioning badly (in my opinion) in which milder methods should not be first employed before resorting to the bougie. In other words, I would not take my Patek-Philippe to the Waterbury shop for regulation if it were running within a minute a day of sun time. If it were losing an hour or two a day, I should want some effort at regulation, no matter how crude the adjustment.

METHOD OF USING EUSTACHIAN BOUGIE

The eustachian tube, which, in spite of all other efforts at regulation is behaving badly, should have the probable benefit which the careful application of a eustachian bougie offers. In such cases, after cocainizing and carefully sterilizing the mouth of the tube with a solution of colloidal silver, I usually insert a small, very flexible whalebone bougie which has been bathed in colloidal silver solution. This is followed in a few days

by repetition with that size, or a size larger if it seems to be warranted, and so on until the caliber is increased to a degree which shows improvement in the function of the tube.

At each application, if possible, I pass the bougie into the tympanum without too much violence, allow it to remain for a minute or two and, on withdrawal, gently massage the walls of the tube by a to-and-fro movement. As I said before, I consider this a ruffianly trick at best, and only employ it when I have failed without it.

Occasionally, when there seems to be a constriction which cannot be passed without undue pressure, I still resort to a method, the technic of which I perfected twenty-five or thirty years ago, in which a gold bougie is made the negative pole of a galvanic current and passed through an insulated catheter. It still works on cases which are too difficult or too slow for the simpler methods, and I consider it almost essential for success in the very rare cases with a fibrous stricture.

That I do not use it more frequently now is due to the fact that simpler methods usually suffice. I still believe its application sound in the cases I have just mentioned. I stopped using it in the simpler cases years ago for two reasons: First, the application is very tedious; second, it worked successfully often enough so that I began to have patients sent to me from all quarters for "a wonderful electric cure for deafness" which I had devised. Half or two thirds of these patients had deafness which was not accompanied by a constricted eustachian tube. I resented being unconsciously thrust into a position which was on the threshold of charlatanism, and gradually rescued myself by throwing the method into the discard, only to be used occasionally when I found that I had failed with other methods.

It may sound a bit cowardly, but I remembered the old adage that it was "better to be a live coward than a dead hero," and, anyhow, if that did not apply I "had other fish to fry." At any rate, I have been asked for the last word on the matter and that is it.

MALIGNANT TUMORS OF THE ANTRUM OF HIGHMORE

END-RESULTS OF TREATMENTS *

GORDON B. NEW, M.D.

ROCHESTER, MINN.

The combination of cautery and radium, as employed since 1917 in the Mayo Clinic for the treatment of malignant tumors of the antrum of Highmore, has eliminated the operative deaths usually associated with this disease, and has produced a higher percentage of cures than previous operative measures. In 1920, I reported [1] the treatment of eighteen malignant tumors of the antrum by this method, emphasizing the fact that there had been a decrease in the percentage of recurrence.

TABLE 1.—*Types of Primary Tumors of the Antrum*

Type	Untreated	Treated	Total
Squamous-cell epithelioma	36	46	82
Sarcoma	5	4	9
Lymphosarcoma	2	2	4
Fibrosarcoma	2	7	9
Osteosarcoma	..	1	1
Adenocarcinoma	1	4	5
Malignant (type of cell not determinable)	1	5	6
Malignant (microscopic examination of tissue not made)	12	1	13
	59	70	129

TABLE 2.—*Types of Secondary Tumors of the Antrum*

Type	Untreated	Treated	Total
Squamous-cell epithelioma	10	20	30
Round-cell sarcoma	1	1	2
Malignant (type of cell not determinable)	..	3	3
Malignant (microscopic examination of tissue not made)	1	3	4
	12	27	39

During the eight-year period, from 1917 to 1924 inclusive, 168 patients with malignant tumors of the antrum were examined. One hundred and twenty-nine of the patients had primary tumors of the antrum, and thirty-nine had tumors of the antrum secondary to tumors of the upper jaw. This division is not absolute, as it is sometimes difficult to determine the probable origin of the tumor. Ninety-seven of these patients were treated by this method; seventy had primary tumors and twenty-seven had secondary tumors.

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* From the Section on Laryngology, Oral and Plastic, Mayo Clinic.

* Read before the American Radium Society, Dallas, Texas, April 19, 1926, and before the American Laryngological Association, Montreal, June 3-5, 1926.

1. New, G. B.: The Treatment of Malignant Tumors of the Antrum, J. A. M. A. **74**:1296-1300 (May 8) 1920.

TABLE 3.—*Age Incidence of Patients with Primary Tumors of Antrum* *

Years	Cases		
	Untreated	Treated	Total
1 to 10	1	2	3
11 to 20	1	6	7
21 to 30	..	4	4
31 to 40	5	8	13
41 to 50	6	15	21
51 to 60	25	17	42
61 to 70	15	14	29
71 to 80	6	4	10
	59	70	129

* The ages varied from 3 to 77 years, the average being 50 years. Seventy-nine per cent of the patients were between 40 and 70.

TABLE 4.—*Age Incidence of Patients with Secondary Tumors of the Antrum* *

Years	Cases		
	Untreated	Treated	Total
21 to 30	1	..	1
31 to 40	1	2	3
41 to 50	2	4	6
51 to 60	2	11	13
61 to 70	4	10	14
71 to 80	2	..	2
	12	27	39

* The ages varied from 29 to 73 years, the average being 55 years. Eighty-seven per cent of the patients were between 40 and 70.

TABLE 5.—*Relative Frequency of Tumors of the Antrum in Males and Females* *

Tumors	Males	Females	Total
Primary			
Untreated	39	20	59
Treated	37	33	70
	76	53	129
Secondary			
Untreated	10	2	12
Treated	27	..	27
	37	2	39
Primary and Secondary			
Untreated	49	22	71
Treated	64	33	97
	113	55	168

* Fifty-eight per cent of the primary tumors were in males; only two of the secondary tumors were in females. It is seen that there are about twice as many males as females with tumors of the antrum.

TABLE 6.—*Side Involved by Tumor*

Tumors	Right	Left	Total
Primary			
Untreated	22	37	59
Treated	35	35	70
	57	72	129
Secondary			
Untreated	8	4	12
Treated	14	13	27
	22	17	39
Primary and Secondary			
Untreated	30	41	71
Treated	49	48	97
	79	89	168

REVIEW OF THE LITERATURE

Greene [2] and Barnes [3] have reported the good results of the combined operative and radium treatment of malignant tumors of the antrum. Greene gives a complete report of eighty-four cases of carcinoma of the antrum treated in the Huntington Hospital. He makes the incision through that portion of the face or mouth that gives the best access to the tumor.

In England there still seems to be a strong tendency toward surgical methods alone in the treatment of malignant disease of the antrum, as was brought out in a discussion of this subject at the meeting of the Laryngological Section of the Royal Society of Medicine in March, 1922.[4]

Harmer [5] reports twenty-three cases; operation was performed on all patients with two deaths resulting. He first performs laryngotomy and packs off the pharynx. Of eighteen patients with carcinoma treated by excision, only two were living more than three years without a recurrence. He states that the best results have been obtained by excision, followed by diathermy and treatment with radium.

Davis [6] reports the results of thirty-nine cases extending over a period of five years. Twenty-one of the patients were observed personally, and eighteen were reported from the Royal Society of Medicine. His method of treatment consists in wide excision of the tumor following preliminary tracheotomy. There were, apparently, twenty-six cases which were followed; thirteen were cases of epithelioma, three of which had not recurred from one to two and one-half years after operation. There were four cases of round-cell sarcoma, all of which recurred; seven of endothelioma without recurrence from three to five and one-half years after operation, and two of spindle-cell sarcoma without recurrence after from five to eight years. McNab [7] advises the use of diathermy and radium in the treatment of these conditions.

Johnson [8] reports on the use of radium treatment alone for carcinoma of the antrum. Radium was inserted directly into the cavity of the

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2. Greene, D. C.: Carcinoma of the Antrum, Am. J. Roentgenol. **9**:591-599, 1922.

3. Barnes, H. A.: The Combined Operative and Radium Treatment of Malignant Disease of Nasal Accessory Sinuses, Boston M. & S. J. **183**:648-656, 1920.

4. Woodman, E. M.: Discussion on Treatment of Malignant Growths, Proc. Roy. Soc. Med., Part 1-2, Section on Laryngol. **15**:35-38, 1921-1922.

5. Harmer, Douglas: Discussion on Treatment of Malignant Growths, Proc. Roy. Soc. Med., Part 1-2, Sect. on Laryngol. **15**:40-41, 1921-1922.

6. Davis, E. D. D.: Malignant Growths of the Upper Jaw and Antrum, Lancet **2**:1090-1092, 1920.

7. McNab, J. C. G.: The Treatment of Growths of the Upper Air and Food Passages, M. J. South Africa **17**:185 (July 22) 1921-1922.

8. Johnson, F. M.: Radium Treatment of Carcinoma of the Antrum, Surg. Gynec. & Obst. **38**:819-822, 1924.

antrum, and was also used on the surface of the face and neck. He describes twenty-four cases: four patients showed no clinical evidence of disease from one to five years after treatment; three were free from the disease one, three, and four years, respectively; one patient was free from the disease for six and one-half years, but the disease recurred later, and eight patients improved with the treatment, but were never free from the disease at any time. The malignant postoperative life of the latter was four years.

TABLE 7.—*Duration of Symptoms of Primary Tumors of the Antrum Before Examination*

Time	Cases		
	Untreated	Treated	Total
2 to 4 weeks	1	..	1
1 to 2 months	3	2	5
2 to 4 months	15	16	31
4 to 6 months	6	9	15
6 to 8 months	8	15	23
8 to 10 months	5	6	11
10 to 12 months	1	2	3
1 to 2 years	9	9	18
2 to 3 years	8	3	11
More than 3 years	3	8	11
	59	70	129

TABLE 8.—*Duration of Symptoms of Secondary Tumors of the Antrum Before Examination*

Time	Cases		
	Untreated	Treated	Total
1 to 2 months	..	4	4
2 to 4 months	1	2	3
4 to 6 months	1	6	7
6 to 8 months	2	2	4
8 to 10 months	..	1	1
10 to 12 months	1	1	2
1 to 2 years	4	5	9
2 to 3 years	1	3	4
More than 3 years	2	2	4
Indeterminate	..	1	1
	12	27	39

SELECTION OF PATIENTS FOR TREATMENT

In the selection of patients for treatment, the usual factors must be considered, namely, the age of the patient, extent of the tumor, previous treatment and duration of the disease. More extensive tumors can be treated by this method than by surgical treatment alone.

The grading of epitheliomas, as brought out by Broders, has been the greatest advance in years in determining the treatment and also the prognosis. A patient with an extensive squamous-cell epithelioma, grade 2, of the antrum might be beyond all chance of cure with the use of cautery or diathermy, whereas a patient with a squamous-cell epithelioma of the same size, but of grade 4, with no metastasis, might have a

reasonable chance of being cured by the use of radium directly into the tumor. In the lower-grade malignant tumors, including the mixed tumors, one must depend on cautery or diathermy almost entirely, whereas in the high-grade epitheliomas and sarcomas, the results depend largely on radium rather than on cautery.

The patients selected for treatment were those who appeared to have a reasonable chance of being cured. A great deal of care was exercised in making the selection, because treatment and only partial removal of a very extensive, low-grade epithelioma may stimulate it to grow faster than it would otherwise.

The untreated patients were those who were too far advanced for any form of effective treatment. These included patients who could not return to the clinic for repeated observation and treatment, and on this account were better taken care of nearer home. Some of these, however, were given palliative treatment at the request of relatives.

TABLE 9.—*Cases Selected for Treatment*

Tumors	Cases	Per Cent
Primary	129	
Treated	70	54
Secondary	39	
Treated	27	69
Primary and secondary	168	
Treated	97	57

TREATMENT

During the eight-year period from 1917 to 1924, inclusive, cautery and radium were employed in the treatment of malignant tumors of the antrum, as outlined in a previous report.[1] In the earlier cases, patients were anesthetized with ether and the tumor cauterized through the mouth, either above the alveolar process or through the palate, whichever was most accessible to the tumor. During the last few years, patients have been anesthetized whenever possible with block anesthesia, 0.5 of 1 per cent procaine being used; then the pharynx was packed with gauze, and nitrous oxide given through the nose as required. Nitrous oxide has always been employed alone when the situation of the tumor did not permit the use of local anesthetics.

Diathermy has almost entirely replaced the use of soldering irons because it requires no protection for the surrounding tissues, and may be employed with greater facility. However, soldering irons were used in practically all of the cases reported. It was brought out previously that treatment for such cases depends largely on the grade of the tumor. Cautery is better for low-grade tumors, whereas radium is the more important for high-grade tumors. The aim is to destroy the tumor

entirely in one treatment. At the time of operation radium is inserted directly into the cavity or to the point in the antrum wall where it seems to be most needed. Jacketed tubes, steel points, or emanation seeds have been employed, as thought advisable. Radium was also used on the surface of the face and neck in the indicated cases, before and after operation. Both the radium salt and emanation seeds have been used in these

TABLE 10.—*End-Results of Treatment of Seventy Primary Malignant Tumors of the Antrum*

Living After Treatment	Patients	Per Cent
8 or more years	1	
7 to 8 years	5	
6 to 7 years	3	
5 to 6 years	2	
4 to 5 years	4	
3 to 4 years	1	
2 to 3 years	2	
1.25 to 2 years	3	
	21	30
Dead, not traced, or with recurrence	49	70

TABLE 11.—*Types of Primary Tumors of the Living Patients*

		Living	
Tumor	Cases	Years	Months
Squamous-cell epithelioma, grade 2	4	7	6
		5	
		4	
		3	
Squamous-cell epithelioma, grade 3	2	5	5
		3	6
Squamous-cell epithelioma, grade 4	2	5	
		4	10
Fibrosarcoma	4	8	5
		7	9
		6	3
		2	
Sarcoma	2	8	
		7	8
Lymphosarcoma	2	7	8
		6	
Osteosarcoma	1	6	8
Mixed-cell sarcoma	1	6	4
Adenocarcinoma	3	2	3
		1	6
		5	2
	21		

cases. Preliminary ligation of the external carotid has not been a routine measure.

It is essential for the patient to return for observation every month or six weeks, so that if a recurrence takes place he may have immediate care. If the patient cannot do this, he should take treatment nearer home where such a procedure may be followed.

END-RESULTS

The end-results in the treatment of malignant tumors of the antrum with cautery and radium have confirmed the conclusions of a previous report in 1920. There were no operative deaths among the ninety-seven patients treated. Of the seventy patients with primary tumors, nine lost the eye on the involved side. Of the twenty-seven patients with secondary tumors, two lost an eye. The end-results are seen in tables 10 to 13.

TABLE 12.—*End-Results of Treatment of Twenty-Seven Secondary Malignant Tumors of the Antrum*

Living After Treatment	Patients	Per Cent
7 to 8 years	2	
6 to 7 years	4	
5 to 6 years	2	
4 to 5 years	1	
3 to 4 years	4	
1.25 to 2 years	1	
	14*	51.8
Dead, not traced, or with recurrence	13	48.2

* All of the fourteen living patients with secondary malignant tumors of the antrum had squamous-cell epithelioma, grade 2.

TABLE 13.—*End-Results of Treatment of Ninety-Seven Primary and Secondary Malignant Tumors of the Antrum*

Living After Treatment	Patients	Per Cent
8 or more years	1	
7 to 8 years	7	
6 to 7 years	7	
5 to 6 years	4	
4 to 5 years	5	
3 to 4 years	5	
2 to 3 years	2	
1.25 to 2 years	4	
	35	36
Dead, not traced, or with recurrence	62	64

CONCLUSION

By the use of cautery, in the form of soldering irons or diathermy, and by the use of radium in the treatment of malignant tumors of the antrum, operative deaths are eliminated, and more patients are cured than by previous operative methods (figs. 1 to 11).

Fig. 1.—*A*, patient with sarcoma of the antrum before treatment; *B*, same patient after treatment; living eight years.

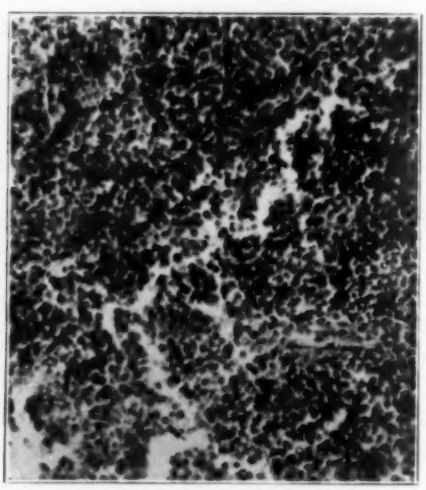

Fig. 2.—Photomicrograph of sarcoma of the antrum (fig. 1). (×120).

Fig. 3.—*A*, patient with squamous-cell epithelioma of the antrum, grade 3, before treatment; *B*, same patient after treatment; living five years and five months.

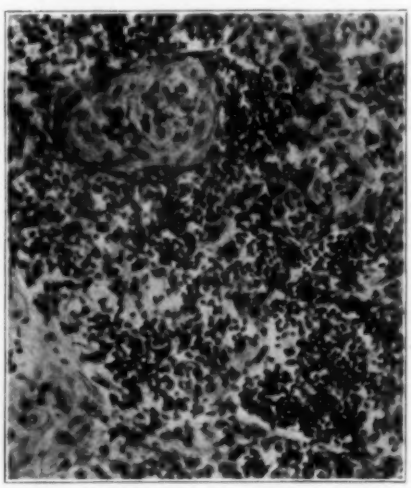

Fig. 4.—Photomicrograph of squamous-cell epithelioma of the antrum, grade 3 (fig. 3). (× 120).

Fig. 5.—*A*, patient with squamous-cell epithelioma of the antrum, grade 4, before treatment; *B*, same patient after treatment; living five years.

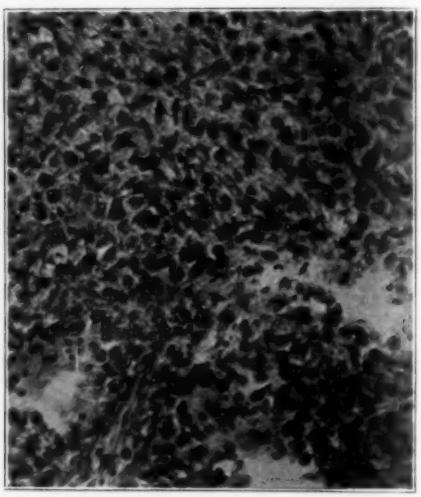

Fig. 6.—Photomicrograph of squamous-cell epithelioma of the antrum, grade 4 (fig. 5). (×120).

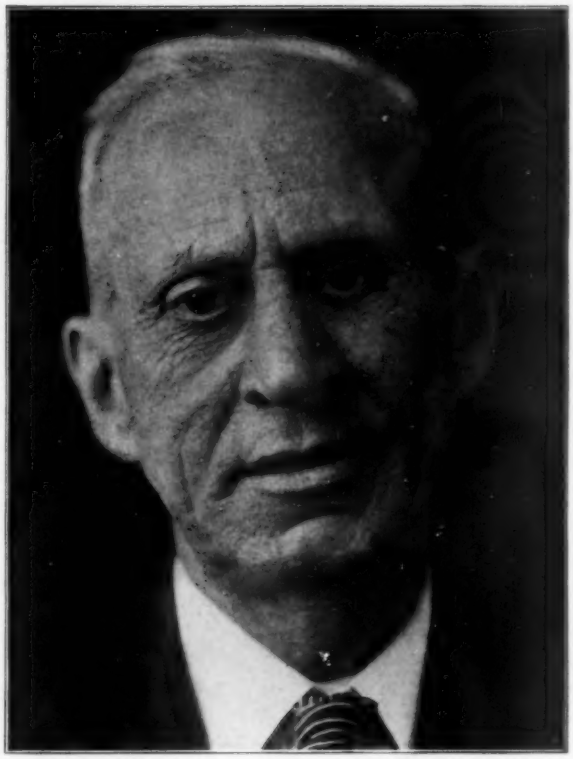

Fig. 7.—Patient who had squamous-cell epithelioma of the left antrum, grade 2, after treatment. Patient living seven and one-half years; he lost the left eye as a result of treatment and is wearing a glass eye.

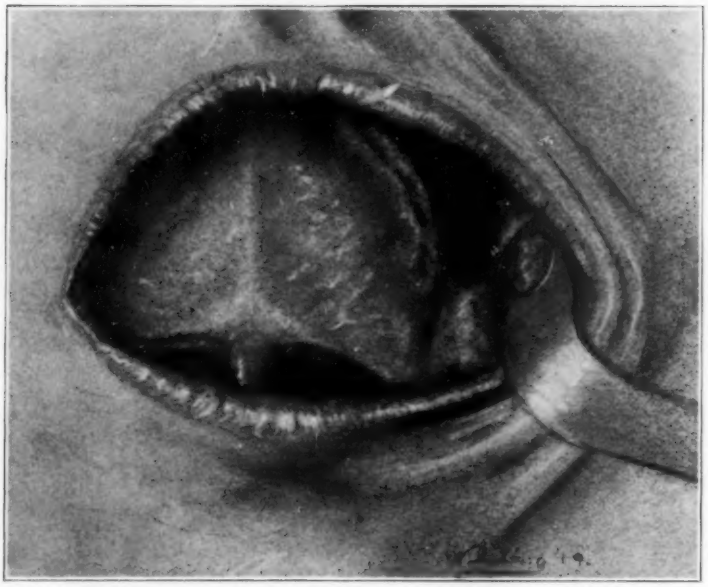

Fig. 8.—Postoperative opening above the left alveolar process. Patient shown in figure 7.

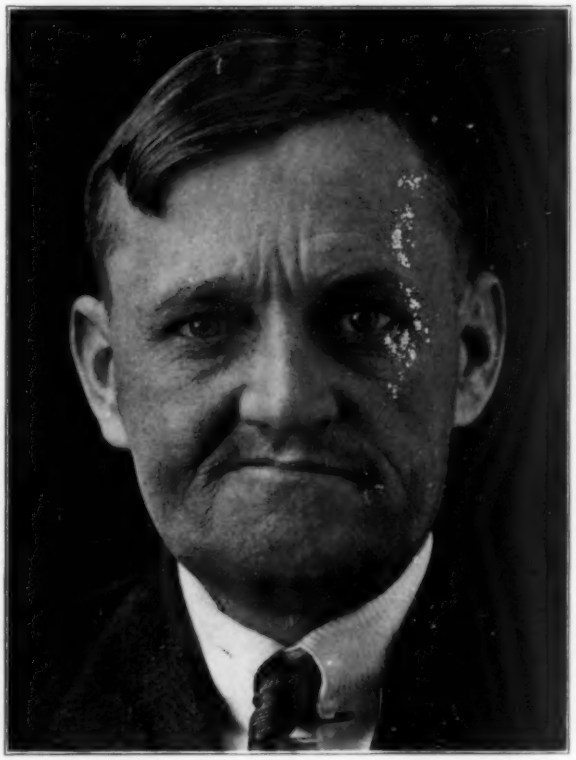

Fig. 9.—Patient who had squamous-cell epithelioma of the upper jaw and antrum, grade 2; after treatment. Patient living seven and one-half years.

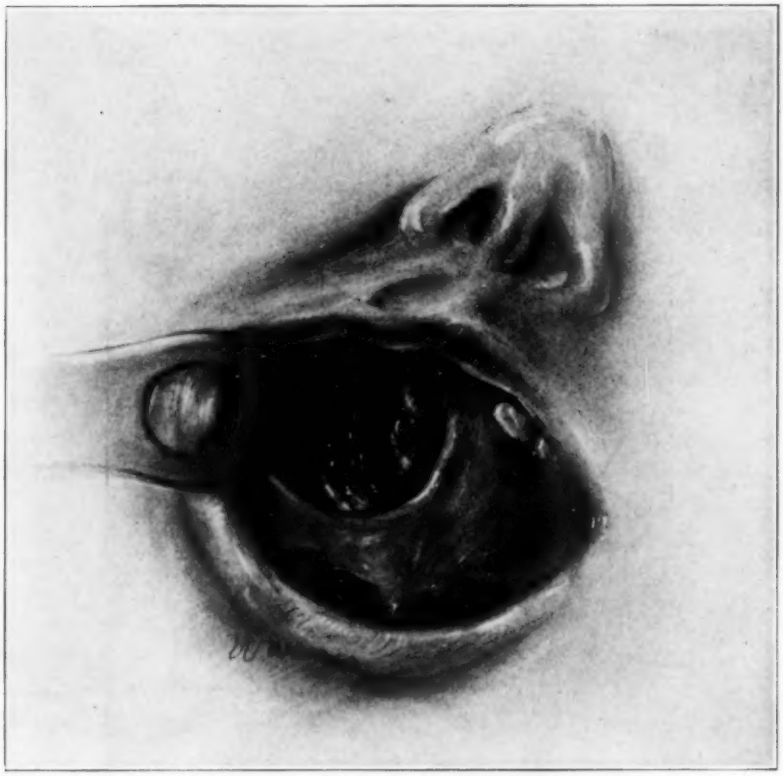

Fig. 10.—Postoperative opening into the antrum. Patient shown in figure 9.

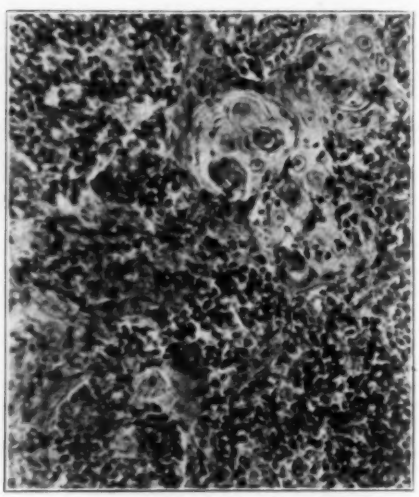

Fig. 11.—Photomicrograph of squamous-cell epithelioma of the upper jaw and antrum, grade 2 (figs. 9 and 10). (×120).

RADIUM IN POLYPOID ETHMOIDITIS

REPORT OF CASES *

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ETIOLOGY

Among the diseases encountered by the rhinologist, one of the least amenable to treatment is hyperplastic ethmoiditis with polypoid change. The etiology of this condition is still a moot question. Agreement seems general that irritation, either mechanical or chemical, plays an important rôle. Whether this is the predominant one is still *sub judice*. The weight of evidence would seem to relegate it to a place of secondary importance, namely, that of an excitant. Irritation does not seem to be effective unless there be an individual predisposition the nature of which is yet undetermined; perhaps its rôle is analogous to the one it plays in the production of cancer. This predisposition is of varying intensity in different persons, as we meet cases of marked polypoid degeneration in patients without recognizable pathologic change in secretion, while many with frankly purulent conditions exhibit no tendency to form polypi. If irritation is the sole cause, we must predicate a marked chemical change of intense character from the normal in the secretion. If we admit the necessity of the presence of some other basic factor which becomes actuated by a proper irritant, our etiologic concept becomes clearer. The suggestion has been made that this basic factor may be the result of an endocrine imbalance, and, though this may be but the substitution of darkness on the right for darkness on the left, the theory seems the most plausible yet offered. Until we arrive at some definite conception of the percentage of cases of ethmoiditis which originated as the hyperplastic type and became infected later as a result, among other factors, of the decreased resistance accompanying such a pathologic change as compared to those in which the polypi developed as a result of the changed secretions secondary to a purulent condition, we have no solid ground on which to base our deductions. Our personal opinion is that polypi seldom develop in cases that are frankly purulent from the start. An acute infection may often be grafted on a mild, slowly progressive type of this disease causing a very rapid florescence. The symptoms of this mild type are so slight that its presence usually passes

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* Read at the annual meeting of the American Laryngological Society at Montreal, Canada, June 3, 1926.

unrecognized—a form of ethmoid disease for which we have already suggested the term larval—and the case may be mistakenly regarded as primarily suppurative.

The frequent association of asthma with ethmoid disease is an added factor, which often makes the lives of sufferers from polypoid ethmoiditis miserable, and should be a further incentive to stimulate our search for a truly curative agent.

TREATMENT

Heretofore the sole method of attack has been surgical, and the results have been gratifying neither to the patient nor to the surgeon. The promptness of return and the volume of new tumor masses have seemed to depend more on individual diathesis—if I may be permitted the term—than on the completeness of the operative procedure.

Any addition to our therapeutic armamentarium that promises cure or even control of this condition should receive a thorough try-out. Radium has been used for some years past, but the scantiness of the literature would not seem to indicate that any thorough test of its efficacy is being made. The probable explanation of this condition lies in the fact that rhinologists have not the element in their possession, and the average radiologist has not the skill necessary for its insertion in the proper location. Sluder [1] reports its use in eight patients, in all of whom the tendency of the polyps to reform was checked by its action, but he claims no cures. Lyons [2] of the Mayo Clinic reports its use in fifty-five cases, though the ultimate results were not available in many of these. He concludes, however, that definitive cures occur more often with radium than without it, and that in the majority of cases the intervals of recurrence are definitely lengthened.

Sluder does not state at what stage of treatment he applies the radium, but Lyons uses it postoperatively only and advises a radical operation in every case rather than a simple removal of the polypi. This is the course that we have pursued, giving the initial exposure as soon as the acute postoperative symptoms have subsided, that is, within a week after a radical operation and a day or two after removal of recurrences. There have always been recurrences after the first irradiation, and our experience coincides with that of Sluder and Lyons in that the intervals have increased between them, and the character of the polypi likewise has changed. At first pure myxoma, macroscopically, the fibrous content has become more noticeable after each irradiation.

We were fortunate in the treatment of our cases, as one of us (G. A. R.) is radiologist at the Manhattan Eye, Ear and Throat Hospi-

1. Sluder, G.: Laryngoscope **34**:124-125 (Feb.) 1924.

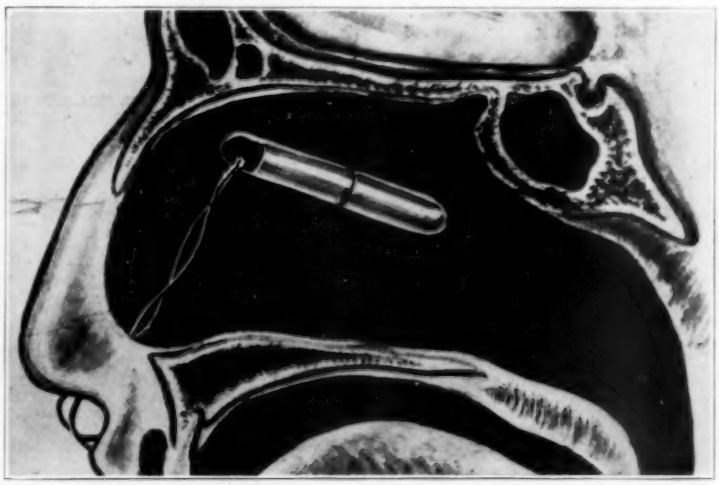
2. Lyons, H. R.: Am. J. Roentgenol. **8**:407 (July) 1921; ibid., **9**:584-587, 1922.

tal, and is skilled in the technic of nose and throat examination. He has prepared the following description of his method of application and dosage:

Normal tissues are less sensitive to radiation than are the neoplastic or hyperplastic, and according to Ewing there are three principles of radiation therapy: First, autolytic degeneration, observed mainly in the group of embryonal tumors; second, caustic destruction, employed in the treatment of adult squamous cell carcinoma; third, growth restraint, illustrated in the slow regression of resistant tumors under deep radiation, and in the treatment of chronic inflammatory hyperplasias. The radiation of polypoid ethmoiditis is an example of the latter method.

TECHNIC

In the first part of our work, radium needles were inserted directly into the nasal polyps, but the results were unsatisfactory because the



Radium capsule in place.

base of the polyps received too little radiation and the diseased ethmoid area was not attacked. It became obvious therefore that the application of radium should be preceded by as complete an operation as possible.

The dosage must be varied in the individual case according to the extent of the process and the reaction of the tissues. The technic now employed is the insertion of a 50 mg. radium tube for two hours, or 100 mg. tube for one hour, into the ethmoid area, and repeated within ten days to two weeks. The patient with an average condition will receive four applications, or approximately 400 mg. hours to the involved area. The gamma rays are employed, as the beta rays which are the softer and more irritating rays are screened off by 0.2 mm. platinum and 1 mm. brass. Radium needles 2 cm. long, with a wall thickness of 0.2 mm. platinum containing 10 mg. of radium, are placed in the brass

capsule which is 3 cm. long and has an external diameter of 5 mm. A double string of silk or dental floss 13 inches in length is attached to a small ring in one end of the tube. Vaseline gauze packing is used to maintain the tube in position and is applied between the septum and tube to prevent overaction of the radium on the septal mucosa. The loose end of the string is strapped securely to the patient's cheek and around the patient's ear, as there is a possibility of the tube being dislodged to the nasopharynx and swallowed. In no case was there pain of marked overaction following the use of radium.

CASE REPORTS

The first four histories are those of private patients, the fifth of one occurring in the practice of my associate, Dr. Jay D. Whitham, which I had the privilege of following. The remaining case reports are from Dr. Robinson's files.

TABLE 1.—*Radium Treatment in Case 1*

Date	Amount of Element	Screenage	Mg. Hours	Remarks
4/17/24	70	0.2 mm. platinum	70	Four 10 mg. needles inserted into polypi in right nares for 1 hour; 3 10 mg. needles inserted into polypi in left nares for 1 hour
5/28/24	40	0.2 mm. platinum	80	Four 10 mg. needles inserted in polypi of right nostril for 2 hours
9/ 4/24	30	0.2 mm. platinum	60	Three 10 mg. needles inserted in polypi of left nostril for 2 hours
10/27/24	80	0.2 mm. platinum, 1 mm. brass	120	One 50 mg. tube, one 30 mg. tube placed in left and right ethmoid region respectively
1/26/25	30	0.2 mm. platinum, 1 mm. brass	60	One 30 mg. tube in right ethmoid region for 2 hours
4/13/25	30	0.2 mm. platinum	60	Three 10 mg. needles inserted into left ethmoid region for 2 hours
11/ 2/25	100	0.2 mm. platinum, 1 mm. brass	150	One 50 mg. tube inserted into each ethmoid region for 1½ hours
12/12/25	100	0.2 mm. platinum, 1 mm. brass	150	One 50 mg. tube inserted into each ethmoid region for 1 hour
1/11/26	70	0.2 mm. platinum, 1 mm. brass	70	One 40 mg. tube to right ethmoid region for 1 hour; one 30 mg. tube to left ethmoid region for 1 hour
Total			820	

CASE 1.—Mrs. L., aged 28, was first seen Oct. 9, 1922. The condition was diagnosed as hyperplastic ethmoiditis with polypi; asthma was also present. A submucous resection and partial middle turbinectomy were performed. About six months later bilateral ethmoidectomy and sphenoidectomy with almost immediate return of the polypi. As the asthma was very distressing when polyps were present, they were removed in great numbers at very frequent intervals for more than a year, when the patient was referred to Dr. Robinson for radium treatment.

The patient was again seen, Nov. 2, 1925. She had twins five weeks previously, and had no asthma during pregnancy, but it had returned two weeks before coming to us. A few small fibrous polypi were present, which were not removed.

Feb. 10, 1926, the asthmatic attacks had recurred. The patient was anemic, nervous and "run down." The polypi were not removed.

April 17, the patient reported that she had no asthmatic attacks for the last four weeks. The nose was free of polypi. May 28, no asthma was present. There were a few fibrous polypi on both sides.

CASE 2.—Mr. L. M. P., aged 36, was first seen Sept. 23, 1919. The condition was diagnosed as hyperplastic ethmoiditis with polypi, with a history of previous removals. The polypi were removed at intervals until June, 1925, when a radical operation on the left side was performed.

TABLE 2.—*Radium Treatment in Case 2*

Date	Amount of Element	Screenage	Mg. Hours	Remarks
7/22/25	100	0.2 mm. platinum, 1 mm. brass	150	One 50 mg. tube applied to each ethmoid region for 1½ hours
7/29/25	100	0.2 mm. platinum, 1 mm. brass	100	As above for 1 hour
8/18/25	80	0.2 mm. platinum, 1 mm. brass	40	One 50 mg. tube applied to left ethmoid region for ½ hour; one 30 mg. tube applied to right ethmoid region for ½ hour
Total.....			290	

CASE 3.—Mr. H. R., aged 42, was first seen May 28, 1923, with a history of removal of polypi at intervals for the past twelve years. Asthma was also present. A bilateral ethmoidectomy was performed in June. There was a recurrence of polypi and return of the asthma two months later. The recurrences were removed for another year. The patient has been free of asthma for the last six months.

TABLE 3.—*Radium Treatment in Case 3*

Date	Amount of Element	Screenage	Mg. Hours	Remarks
12/17/25	100	0.2 mm. platinum, 1 mm. brass	150	50 mg. tube applied to each ethmoid region for 1½ hours
1/13/26	100	0.2 mm. platinum, 1 mm. brass	150	50 mg. tube applied to each ethmoid region for 1½ hours
2/24/26	100	0.2 mm. platinum, 1 mm. brass	100	50 mg. tube applied to each ethmoid region for 1 hour
Total.....			400	

CASE 4.—Mr. F. L., aged 33, was first seen June 2, 1925, suffering from hyperplastic ethmoiditis with polypi. The polypi have been removed several times. A bilateral ethmoidectomy was performed in June, and the patient was referred for radium treatment. Jan. 25, 1926, one large polyp on the right side was removed, which operation was followed by severe hemorrhage that night, necessitating packing. On May 19, small polypi were present.

TABLE 4.—*Radium Treatment in Case 4*

Date	Amount of Element	Screenage	Mg. Hours	Remarks
7/15/25	120	0.2 mm. platinum, 1 mm. brass	120	70 mg. tube applied to left ethmoid region; 50 mg. tube applied to right ethmoid region
7/29/25	100	0.2 mm. platinum, 1 mm. brass	100	50 mg. tube to right and left ethmoid regions
8/28/25	50	0.2 mm. platinum, 1 mm. brass	50	To left ethmoid area
9/29/25	15	0.2 mm. platinum	22.5	Three 5 mg. needles inserted into base of polyp in right nares
11/ 7/25	40	0.2 mm. platinum	40	Four 10 mg. needles inserted into large polyp for 1 hour
2/ 6/26	100	0.2 mm. platinum, 1 mm. brass	100	50 mg. tube applied to ethmoid area on both sides for 1 hour
Total.....			432.5	

CASE 5.—Mr. M. C., aged 38, had polypoid ethmoiditis of long duration. A double ethmoidectomy was performed, May, 1925, by Dr. J. D. Whitman.

TABLE 5.—*Radium Treatment in Case 5*

Date	Amount of Element	Screenage	Mg. Hours	Remarks
11/19/25	100	0.2 mm. platinum, 1 mm. brass	150	50 mg. tube applied to each ethmoid area for 1½ hours
1/ 7/26	130	0.2 mm. platinum, 1 mm. brass	130	100 mg. tube applied to left ethmoid for 1 hour; 30 mg. tube applied to right ethmoid for 1 hour
Total			280	

May 3, the polyps and granulation tissue were markedly reduced and the discharge became much less.

CASE 6.—H. L., aged 33, was referred for radium treatment July 20, 1923. Nasal polyps had existed for the last fourteen years, and had been removed surgically about thirty times. A complete ethmoidectomy and submucous resection was performed four years prior to this. Polyps again appeared and were removed at intervals of two to five months. At the time the patient was referred for radium treatment the entire nasal mucous membrane was polypoid; there was a large amount of mucopus present on the outer wall and floor of both nasal cavities. Table 6 is a record of the radium treatment.

TABLE 6.—*Radium Treatment in Case 6*

Date	Amount of Element	Screenage	Mg. Hours	Remarks
7/20/23	60	0.2 mm. platinum	120	30 mg. to each side of nose
8/ 2/23	30	0.2 mm. platinum	60	Two 10 mg. needles inserted into polyps on left side; one 10 mg. needle in right side
9/27/23	20	0.2 mm. platinum	40	One 10 mg. needle in plaque to each side for 2 hours
10/30/23	40	0.2 mm. platinum	80	Two 10 mg. needles inserted into polyps in each side
12/10/23	15	0.2 mm. platinum	37.5	Three 5 mg. needles inserted into polyps
1/31/24	30	0.2 mm. platinum	60	Three 10 mg. needles inserted into polyps in left nares for 2 hours
Total			397.5	

For nearly three years as a result of radium treatments there has been an absence of nasal obstruction, the mucopurulent discharge has ceased and the polypoid tendency has been definitely checked.

CASE 7.—M. R., aged 42, was referred for radium therapy May 11, 1925. The patient had nasal polyps and a constant nasal discharge for many years. A partial ethmoidectomy was performed Dec. 26, 1923, which did not improve the condition. Examination showed the nasal mucosa thickened and "water logged." A profuse watery discharge but no polyps were present. Two hundred and ten milligram hours of radium have been applied during the last year to the ethmoid area on each side. The nasal discharge had practically disappeared, there was no obstruction to breathing and the patient's general condition was very much improved.

CASE 8.—E. R. W., aged 40, had nasal polyps for fifteen years, with numerous operations. Submucous resection and partial ethmoidectomy was performed Dec. 10, 1921. The polyps recurred and were removed at frequent intervals. On March 1, 1924, a complete ethmoidectomy was performed, and a week later 40 mg. of radium was applied to each ethmoid area for two hours. The patient had ample breathing space after two years, but a few fibrous polyps were noticed in the right ethmoid region.

CASE 9.—D. P., aged 36, had nasal obstruction for six years, with frequent sneezing attacks. On Feb. 2, 1922, a double ethmoidectomy was performed. There was a prompt recurrence of polyps followed by a secondary ethmoidectomy on March 22, 1924, and 40 mg. of radium was applied to each ethmoid area for two hours. One year later there was no nasal obstruction, the discharge being markedly reduced.

CASE 10.—D. M., aged 26, was referred Oct. 15, 1925, with a history of headaches, nasal discharge and "colds" for the last five years. There were five operations during the last two years, including a partial ethmoidectomy. Examination showed a typical polypoid sinusitis with a large group of polyps in the left ethmoid area. A total of 500 mg. hours radium, within three months, were applied to the ethmoid areas. The polyps appeared more fibrous, the headaches were relieved, and the discharge was lessened.

CASE 11.—P. W., aged 16, had three operations for removal of polyps from the right side of the nose, during the last two years preceding the admission to the radium clinic on April 21, 1924. Two treatments were given, amounting to 80 mg. hours, but the patient did not return to the clinic until nearly two years later, when the right side of the nose was entirely filled with polyps. On April 21, 1926, an ethmoidectomy was performed. Two weeks later 100 mg. tube of radium was applied to the ethmoid area for two hours.

CASE 12.—D. G., aged 31, had nasal obstruction to the right side of the nose for over two years, and was referred for radium treatment ten days after the removal of a single large polyp arising from the posterior ethmoid cells on the right side of the nose. Four hundred and twenty-five milligram hours of radium were applied for five months, and at the time of writing there was no recurrence of polyps.

CASE 13.—M. M., aged 37, had a profuse mucopurulent nasal discharge with polyp formation for three years. Frequent removal of the polyps did not improve the condition. After 100 mg. hours of radium to each ethmoid area, the nasal secretion became less. An ethmoidectomy was advised, to be followed by further radium treatment.

CASE 14.—M. H., aged 28, was referred for radium treatment Dec. 10, 1925. Ethmoidectomy had been performed six weeks previously. The patient had nasal obstruction and asthma for several years. A 50 mg. radium tube was applied postoperatively to each ethmoid cell for one hour. The nose was free from polyps nearly six months later, and there have been no asthmatic attacks. The patient is kept under observation, and further radium treatment will be given if necessary.

CASE 15.—P. R., aged 28, had a chronic nasal discharge for the last five years. Polyps were removed at frequent intervals, and recurred after ethmoidectomy. Two hundred milligram hours of radium were applied in January, 1926; the granulations were less and the nasal obstruction was relieved as a result of the radium treatment.

CASE 16.—S. L., aged 32, had nasal obstruction since she was 8 years of age. Eight operations had been performed for the relief of obstruction, which was due to nasal polyps, but the discharge continued. For several years the patient has had attacks of asthma. Three radium treatments, amounting to 315 mg. hours, were given two weeks after ethmoidectomy in March, 1926. The attacks of asthma disappeared and the discharge has markedly lessened.

SUMMARY

Objection may properly be made that these case reports are too few, too incomplete and too recent to be of much value. However, as the purpose of the paper is frankly intended to be a stimulus to others

to follow the trail blazed by Sluder, no further apology will be made for its recognized defects.

Complete ethmoidectomy was performed in twelve patients (cases 1, 2, 3, 4, 5, 6, 8, 9, 11, 14, 15, 16); partial ethmoidectomy in two patients (cases 7 and 10) and no operation in one patient (case 13). It is doubtful if case 12 belongs in the category of cases under discussion. Four subjects had asthma (cases 1, 3, 14, 16).

All patients were markedly benefited subjectively. Asthma was controlled whenever it was a complicating factor. Definitive cure can be claimed in none.

Taking into consideration the adverse factors already noted as tending to minimize the value of any conclusions that may be drawn, nevertheless, the following tentative ones are apologetically submitted for consideration.

CONCLUSIONS

Experience with this method of treatment corroborates the conclusions of the reports of Sluder and Lyons, namely:

1. The exhibition of radium should follow surgical intervention, preferably a radical operation, as soon as conditions warrant.

2. Fifty milligrams of radium, screened by 0.2 mm. of platinum and 1 mm. of brass for one hour, or 100 mg. for two hours, may be used.

3. This may be repeated within ten days to two weeks.

4. No pain or marked irritation has occurred.

5. The intervals between recurrence of polypi are lengthened.

6. The amount of polypoid tissue formed is diminished.

7. Collateral conditions, such as asthma, are relieved.

8. Associated purulent conditions are not directly benefited.

9. The question of definitive cure must wait on wider experience and longer elapsed time in subjects apparently cured.

10. Radium is the most effective agent yet found for the control of this condition.

IODIZED OIL IN THE DIAGNOSIS OF NASAL SINUS CONDITIONS *

HENRY M. GOODYEAR, M.D.
CINCINNATI

I wish to present the accompanying roentgenograms from a series of nasal sinuses injected with iodized oil (figs. 1, 2 and 3). The antrums were injected through the inferior meatus by means of a straight trocar and a record syringe. From 2 to 6 cc. of the warmed iodized oil (iodipin brand, which is an addition product of iodine, 40 per cent, and sesame oil) was injected into each antrum. It was found that moist pledgets of cotton placed in the middle meatus helped to retain the solution. Each patient was sent to the roentgen-ray room immediately after injection. The sphenoid sinuses were injected through the anterior wall with from 2 to 4 cc. of the iodized oil (fig. 4). Injection of the frontal sinuses was found to be more difficult and rather unsatisfactory on account of the escape of oil by gravity.

In this series thirty-four sinuses were injected. The procedure was found to be simple and the iodized oil without irritation to the nasal membranes. In fact, it had considerable medical value.

Three patients were injected with 13 per cent sodium iodide solution in glycerine, but the shadows were insignificant. Iodine ointment also was tried in open sphenoids without effect. Ten per cent solution of iodized oil did not offer sufficient resistance to roentgen rays.

All operations on antrums in this series were performed under local anesthesia with a nerve blocking through the anterior and posterior palatine foramen. The membranes were dissected loose and removed *en masse* (fig. 5) and the general irregular outlines were compared with the iodized oil shadows in the roentgenograms.

CONCLUSIONS

The very definite shadow cast by the iodized oil is an aid to diagnosis in nasal sinus conditions, especially in cases with uncertain histories of sinus infection, and when lavage yields no return of secretion.

The thickness of the membranes and the presence of polypi and cystic changes can be discerned in a large percentage of cases.

Iodized oil is an aid in the detection of extensions of the sphenoid sinuses into the greater or lesser wings of the sphenoid bone, and in determining the relation of the sphenoid sinus to the posterior ethmoid cells and the sella turcica.

556 Doctors' Building.

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* Reported before the Cincinnati Academy of Medicine, March 29, 1926.

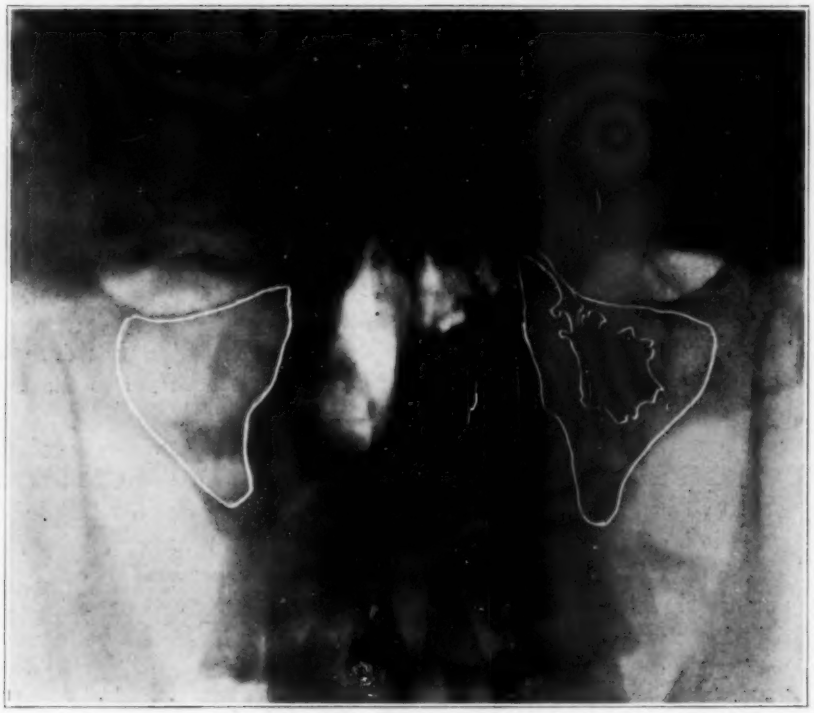

Fig. 1.—Front view of left antrum from a patient with chronic bronchial cough of ten years' duration; the irregular outline produced by the cystic membrane should be noted (fig. 5).

Fig. 2.—Side view of antrum; operation revealed a thick cystic membrane (the patient was asthmatic).

Fig. 3.—Front view of right antrum, showing flow of iodized oil to ethmoid area twenty minutes after injection; this illustrates the ease with which an antrum may infect the ethmoids secondarily.

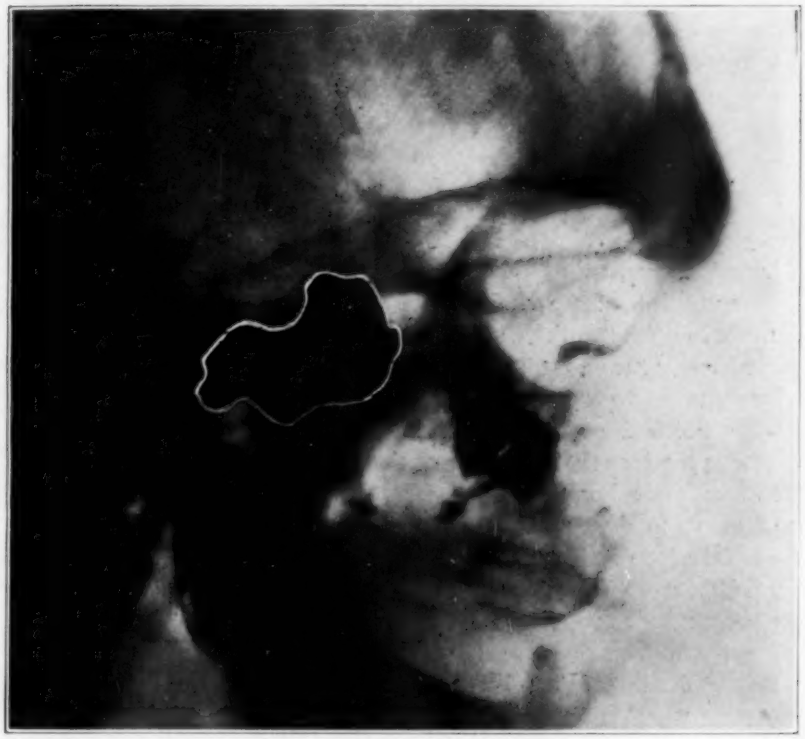

Fig. 4.—Side view of left sphenoid sinus.

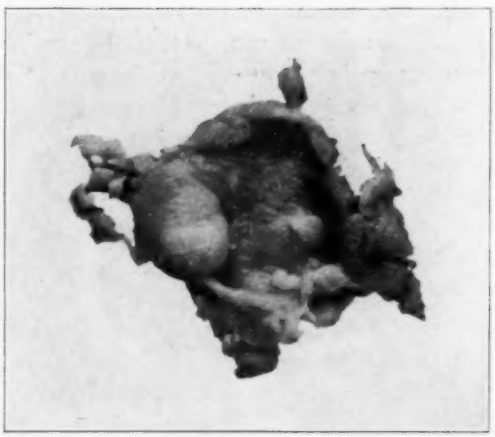

Fig. 5.—Cystic membrane from antrum shown in figure 1.

THE INTERPRETATION OF SPEECH BY TACTUAL AND VISUAL IMPRESSION *

ROBERT H. GAULT, PH.D.

Professor of Psychology in Northwestern University, on leave with the National Research Council

WASHINGTON, D. C.

The subject matter of this paper is an account of my experiments, under the auspices of the National Research Council, in which a finger tip is made to do the work of an ear. It is a provoking question how far the primitive organs of touch, the mother of all our senses, can go vicariously toward providing what corresponds to hearing. The problem with which I am concerned falls within the scope of general psychology; particularly within the sections on the sensitivity of the skin, on identification and on the development of fixed concepts and meanings. It runs along to the problem of the substitution of one function for another, namely, of touch for hearing. Can one "hear" through the skin? If so, can one interpret what one "hears?" I am asking these questions in relation to speech.

To make an iron-clad test, I have had to select those totally deaf as subjects for the experiment, because it is imperative to keep away from the question whether those on whom the experiments are made receive auditory cues from the stimuli; whether they receive such cues through the air or by way of bone conduction to the inner ear. This question has been eliminated both by the selection of cases and by control experiments in relation to others, whose audiometric records leave room for the most remote possibility of catching even an occasional auditory cue in the conditions of the experiment.

Before proceeding, I turn for a short space to the special psychologic process of understanding spoken language on the part of persons who are equipped with normal sensory organs. Here are some psychologic factors that are tangible enough and others that are all but intangible. A superficial analysis of this situation will serve a good purpose in relation to my work on teletactile audition.

In the first place, when you speak and I understand what you are saying, I hear the sounds of speech. Rhythm, accent, emphasis and varying tempo stand out rather prominently. I see your moving lips, your facial expression and your gestures. All these are tangible enough. Eliminate vision as at the telephone and my efficiency is reduced; there

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* Read before the American Otological Society, Montreal, June 2, 1926.

* The Bell Telephone Laboratories have provided the instruments that are being used in this research.

is further reduction when you speak in a monotone and in uniform tempo.

By the side of these there are other factors that come to light only after somewhat close self examination. I, for my part, and probably the most of us, see, in our mind's eye, images of objects that are being verbally described. Some of us feel the movement of the speaker's words as if we were bodily running after his rhythm and pounding when he is emphatic. There is a feeling of incipient movement on our part while we are listening to his speech; movement that is more or less appropriate to the succession of his words and sentences. These are kinesthetic or motor factors that accompany the understanding of speech. In my own experience these elements are unmistakably present.

When I am reading from the silent page I have advantage not of hearing but of vision alone among the most tangible factors. But there are auditory images too, for I hear the words in my mind's ear. And the kinesthetic accompaniments are there also. For the words on the page take a swing unto themselves as if they were being spoken. When a paragraph remains dark and I re-read it with altered rhythm, emphasis and tempo, its meaning emerges. Incidentally also—and this is of no mean importance—these feelings of movement enhance the pleasureableness of silent reading as they do, too, in relation to hearing and understanding speech. At least I can say so, speaking for myself, and very emphatically.

Here are considerations that lie very near to the language problem among the totally deaf; and from them I have taken cues that have guided me very profitably, I believe, in the course of my experimentation.

As students of the art of lip-reading, the deaf acquire very little appreciation for the movement of speech. Speech for them is something relatively flat on the face of the speaker. It lacks the life and thrill that we acquire from it. Here is a real handicap in itself that is secondary to deafness. It curtails understanding and enjoyment of both speech and reading, and places an obstruction in the way of a rich mental furnishing. To modify this curtailment, the deaf must have more cues as to the meaning of speech and more sources of enjoyment in it.

I have been able to demonstrate not once but repeatedly that practical cues of meaning can be provided, and that sources of enjoyment of the speech of others and of silent reading can be set up for the advantage of the deaf. These demonstrations have been made through the agency of the sense of touch.

SYSTEM

I use an electro-magnetic receiver and a transmitter. The receiver is held in the hand. An amplifier is in circuit between the transmitter and the receiver. All vibrations within the system are amplified

approximately 175 times. In this situation when the tip of a finger of the "listener" is resting lightly against the diaphragm and one is speaking into the transmitter, the "listener" feels the vibration of the diaphragm. There is no mistake about it. The actual pressure against the skin is very slight. A physical laboratory could measure it. It is safe to say that it never comes within a long way of 2 mg., which is supposed to indicate the intensity of the least single stimulus on a finger tip that will occasion a tactual sensation. But in our situation a summation of much slighter stimuli that succeed one another with enormous rapidity makes up for deficiency in stimulus intensity.

Our first question is: Can one sense tactually the sounds of speech? It can be answered briefly. One can sense even an unvoiced labial or guttural, or a sibilant.

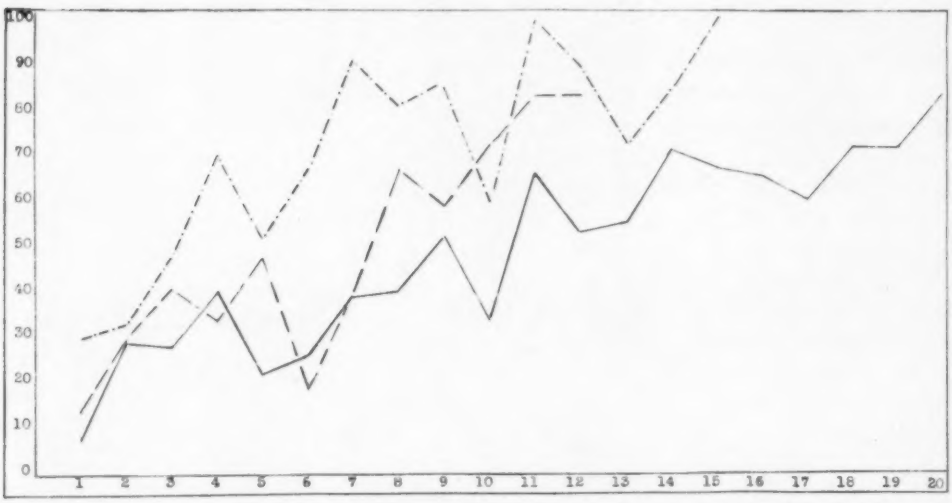

Chart 1.—Learning curves on ten vowel and diphthongal qualities. The subjects are indicated thus: E. C., dot and dash lines; E. B., broken lines; D. C., solid lines.

The second question: Can one discriminate the sounds of speech by their feel on the skin? This question can be answered indirectly by observing the course of learning to identify various groups of stimuli. Take, for instance, the ten vowel and diphthongal qualities; "a" (ate), "er" (eat), "i" (ice), "o" (oat), "u" (you), "oi" (oil), "ou" (out), "er" (refer—middle western), "oo" (boot), "aw" (awe). The curves shown in chart 1 indicate the course of learning on the part of three representative subjects. D. C. and E. B. had no experience whatever in our laboratory prior to the date on which they began exercises on the qualities I have mentioned in the foregoing. E. C. had had experience with the first eight of these qualities, but from May 1, 1925, to the date

indicated on the chart she had not been inside our laboratory. When she left the laboratory on May 1, 1925, she had attained to an accuracy of 52 per cent in identifying the first eight of the qualities referred to. It is literally true, as I can testify out of my own experience, that no two of these stimuli occasion the same tactual sensation complex. Our subjects themselves can describe certain outstanding differences among

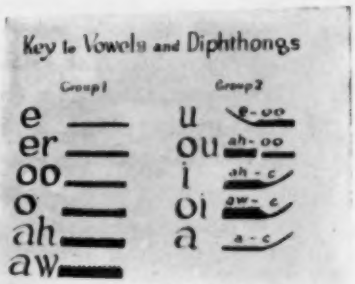

Chart 2.—Graphic representation of ten vowel and diphthongal qualities as felt on the skin. To an unknown extent, these characteristics undoubtedly are produced by the instrument.

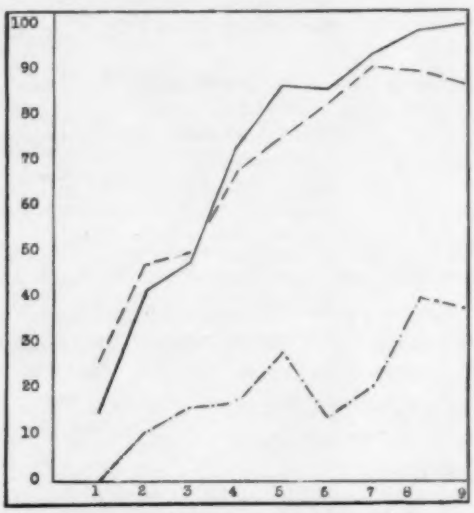

Chart 3.—Learning curves on 120 sentences. The subjects are indicated thus: M. N., solid line; H. A., broken line; R. H., dot and dash line.

these qualities, and we have embodied them graphically in chart 2. This enables us to go a little way toward telling our subjects what to look for in their complex tactual impressions. Herein is an improvement in technic that undoubtedly makes the difference in speed of learning between D. C. and E. B. in chart 1. E. B's curve is typical of a half dozen that have developed in the last few months with improved technic.

As further demonstration of capacity to distinguish forms of speech by their feel, I refer to chart 3. Here are three learning curves that afford a view of the capacity of subjects to distinguish sentences and to learn distinctions among them, so as to identify them as they are felt one after another in the finger tip. One hundred and twenty colloquial sentences were the stimuli. They were read into the skin of the subjects at the rate of twenty a session till the whole group had been presented. Thereupon the process was repeated in a different order, each one, meanwhile, trying to write on his pad what the successive complexes of tactual stimuli meant. The curves plotted here represent only nine complete readings of the whole group. These subjects are congenitally defective. They have some residual hearing; but in the conditions of our experiment they obtain no auditory cues. This statement I am able

TABLE 1.—*Learning Curves on Ten Vowel and Diphthongal Qualities* *

Subject	Age	Deafness	Audiometric Record	Previous Laboratory Experience	Number of Sessions	Date, Initial
E. C.	25	Congenital	35-40	50 hours	15	3/25/26
E. B.	23	Congenital	35-35	None	12	3/25/26
D. C.	22	Congenital	0-0	None	20	10/16/25

* Tables 1 and 2 refer to the subjects in charts 1 and 3.

TABLE 2.—*Learning Curves on One Hundred and Twenty Sentences*

Subject	Audiometric Record	Laboratory Experience	Aggregate No. of Hours
M. N.	50-55	10/8/24 to 1/29/26	120
H. A.	20-25	6/11/25 to 1/29/26	80
R. H.	20-75	12/1/25 to 1/29/26	60

to justify by reason of the fact that when we place any one of them in a situation in which a person of normal hearing can obtain no auditory signs from the stimuli, he nevertheless reports the meaning of his tactual impressions with unabated accuracy. On Jan. 29, 1926, when work first began on these 120 sentences, the three subjects, M.N., H.A. and R.H. had done, respectively, an aggregate of only 120, 80 and 60 hours of work in our laboratory.

The foregoing is a sufficient answer to the question whether one can discriminate the sounds of speech by their feel on the skin. How far one can go in this direction is a subject for experimentation. Up to this moment, under our laboratory conditions, they have learned a few hundred words and sentences. It is difficult to say how many they can handle for the reason that their familiarity with certain elements of speech enables them to synthesize to a certain degree, and thus to interpret words and sentences that had never been felt as such before. Thus, two of our group, given a good chance, can today pick up a

story couched in colloquial speech even though they have nothing to go by but its feel instrumentally communicated to the finger tips; and of unpracticed words in isolation they can interpret seven or eight times as many as chance would lead us to expect.

As an exhibit in this connection I reproduce here a story ("a" in successive groups, 1, 2, 3, etc.) that we used in our laboratory procedure on May 11, 1926, and on that day only. It contains 110 words. The horizontal strokes (*b*) represent the subject's attempt at counting the words as they were felt. The perpendicular lines here and there represent pauses as she felt them. Short dashes above a longer one represent so many syllables in a word. The letters above a horizontal line were made by the subject in her attempt to recognize the vowel, diphthongal or consonantal elements that enter into the words respectively. Finally the words below the line (*c*) she filled in while attempting her interpretation. The figures in parenthesis at the right represent the number of words that were correctly reported in the successive sentences. The check marks (*) are made by the experimenter when he is estimating the subject's degree of accuracy.

THE IRISHMEN AND THE CAT

H. A., May 11, 1926.

Audiometric 20-25. Congenital.

Correct: Seventy-eight of 110 words, 71 per cent.

Correct: Five of fifteen sentences, 33 per cent.

(Observe close approximations in seven sentences. "Correct," here and elsewhere in this paper means literally 50.)

Aggregate laboratory hours, 180.

1. a. Two Irishmen were walking through the woods.
   b. — - - - er - - er oo
   c. An Irishman named Andy lived at (1)

2. a. They saw a cat in a tree.
   b. — — — — — — —
   * * * * * * *
   c. They saw a cat in a tree. (7)

3. a. It was a wild cat.
   b. — — — — —
   * * * *
   c. It was a Tom cat. (4)

4. a. However, they did not know it.
   b. — — — — — —
   * * * * *
   c. Fortunately they did not know it. (5)

5. a. They thought it was a tame house cat.
   b. — — — — — — —
   * * * * * * *
   c. They thought it was a stray house cat. (7)

6. a. They thought it would be fine to catch the cat and take it to town.
   b. — a — aw — — — e i — — t — — t — t — — —

1. a. I am glad to see you today.
   b. oo oo u oo aw
   c. I you today. (3)
2. a. I wonder where the boys are this afternoon.
   b.
   c. I this afternoon. (3)
3. a. Do you think they are playing baseball?
   b. oo u r
   c. Do you think they are playing baseball? (7)
4. a. Do you like to watch a baseball game?
   b.
   c. Do you like to the baseball game? (6)
5. a. How many games did you go to this year?
   b. u r
   c. who you (1)
6. a. Do you like to play golf?
   b. oo u i
   c. Do you like to (4)
7. a. Do you prefer golf to baseball?
   b. oo u
   c. Do you prefer golf to baseball? (6)
8. a. I like to play golf.
   b.
   c. I like to play golf. (5)
9. a. Did you ever try to play it?
   b.
   c. you ever it. (3)
10. a. How many holes did you play?
    b. ou
    c. How many do you play? (4)

COMMENT

These are illustrations of teletactile audition; and they mean a deal more than appears on the surface. They indicate that our subjects are able to remember speech in terms of touch or tactual images as you

and I remember it in terms of auditory images. They anticipate tactual images. Thus, on one occasion, when one of the 120 sentences (chart 3) had been pronounced, a subject said: "I've been looking for that all day." We may truthfully say that, in an elementary way, our subjects are thinking in tactual terms. All the while, there is going on in them something that we may describe as a process of becoming saturated with a language sense.

The experimenters hasten this process by all means at their command. Every evidence of this progressive saturation is one more potion of good wine; for on the side of language in its broadest sense is the deficit of the deaf and we welcome with open heart any means, however bizarre in the eyes of the skeptic, provided that it tends to wipe out the deficit.

We are, therefore, encouraged to proceed on the theory that organs of touch may substitute for organs of hearing as agencies through which the language sense may be developed in the deaf. When a sentence is read into their fingers, they try to write a stroke for each word if they cannot write the words themselves. They try to indicate by appropriate marks where emphasis occurred; where there was a pause and where there was a group of words that was spoken more rapidly than others. More recently, they have been required not only to do the marking I have just now referred to and to fill in the words as far as possible, but also to give vocal utterance to each sentence when they once know what it is. This makes its own independent contribution to the sum of kinesthetic or motor language factors, besides adding to the subjects' skill in using his vocal organs. We have made use of the dictaphone cylinder to give us a certain objective evidence of progress in vocal expression. Records taken before and after a given course of training and then put on the machine for comparison tell the story; and they tell it in a more understandable way than does the oscillogram, though its scientific value is subordinate.

BY-PRODUCTS

Altogether, these exercises are the sources of an unexpected result. For our subjects can mark a page of an unfamiliar story so as to indicate with reasonable accuracy how a good reader would render it. Twenty deaf students who have never had experience in our laboratory are 28 per cent inferior to those who have been trained in this respect. I interpret this as an indication that our seasoned subjects have gained from their practice a degree of saturation with the kinesthetic factors in language, and that these factors have been associated with the forms of speech; so that not even the printed page is any longer a flat thing in the experience of the deaf, although it is very nearly so for those who have not felt speech as our subjects have done times almost without number. On the contrary, the kinesthetic, or motor element, imparts

even to the words on the printed page a character that they cannot possess without it; a character by reason of which they thrill the reader or bore him according to the manner in which they have been put together or composed. And this thrill is something that our group are acquiring through the medium of touch. "How does the water come down at Lodore" they greatly enjoy, and they prefer it to every one of six others, no two of which are of the same rhythm. Curiously enough —so it first appeared to me—they enjoy the Lodore verses more than the following line in the same meter: "How do you like to go up in a swing." The difference is probably in the predominating vowel qualities in the verses. In fact, there is sufficient positive evidence that this is the case. But that is an investigation by itself. It runs into the ques-

TABLE 3.—*Test of Lip-Reading versus Lip-Touch-Reading*

	Words		Sentences	
	Lip Reading	Lip-Touch Reading	Lip Reading	Lip-Touch Reading
N	43	79	0	4
C	70	79	3	4
A	40	75	2	4
B	23	51	0	1
Group	176	281	5	13
Gain		59.6%		160%
F*	112	100	9	6
Loss		10.7%		33.3 %
Same Test on Different Group of Subjects				
J	45	80	2	3
K	47	59	1	3
B	60	78	2	4
M	50	71	1	3
Group	202	297	6	13
Gain		47%		117%

* The record of F is set down separately, because to this date he has had an aggregate of only thirty-two hours of training in the laboratory, whereas the minimum that the others have had is 180 hours. Furthermore, F is an exceptionally good lip-reader. No amount of training in his case, therefore, could produce the same result as in the case of the less proficient.

tion whether it is possible to communicate the vibrations of music to the totally deaf in such manner that they can have some degree of enjoyment from it.

The relations of this work to reading and to the enjoyment of language are by-products that have grown out of the main enterprise. They are each one important enough to be considered as main issues in themselves, though they were not in my thought at the outset of the experiment.

There is one other by-product of the research that is of so great popular interest and practical value that it alone justifies the entire piece of work. I refer to our experience with tactual impressions as aids to lip-reading.

The deaf person can feel so much of speech that he cannot see on the face of a speaker; such as differences among homophenous words

like "aim" and "ape;" "decrease," "degrees," "decrees;" the rhythm, emphasis, accent and tempo of spoken discourse. When he adds the feel of all this to the vision of the speaker's face, as we have demonstrated repeatedly, he can understand speech up to over 100 per cent more accurately than he can do by vision of the face alone. Here is assurance of the ultimate speeding up of instruction in schools for the deaf, while at the same time guaranteeing the use, rather than the disuse, of language as we know it.

An example of results of a test on this point may be seen in table 3. On May 6, we brought Miss Timberlake of the Volta Bureau into the laboratory to make the test as an unprejudiced witness. She had prepared two lists of sentences of approximately equal difficulty—ten in each list. One of these she herself presented as a lip-reading test, and the other as a lip-touch-reading test. That is, in relation to the first list the subjects saw her face but had no contact with the instrument, whereas in relation to the second they both saw her face while she was speaking and felt her words through the instrument. The results have been tabulated both for the number of words that were reported correctly and for the number of sentences so reported, and by a correct report of a sentence I mean literally correct, word for word. A report is counted as wrong if there is an error in one or more words, even though the sense may have been apprehended. This is manifestly unfair to the subject. But once this condition is understood, the results of the test are all the more striking.

When Miss Timberlake's work had been concluded, we made use of her own material and identical method in relation to another group of subjects. The results are tabulated in the lower portion of the table. (Mr. Crane, experimenter.) In this case the same direction of improvement is indicated as in Miss Timberlake's test, but in less degree: 47 per cent for words and 117 per cent for sentences. Of course the figures in this tabulation are too small to be most meaningful when gains and losses are expressed in percentage terms. They do show a tendency, however, that is unmistakable; and when these data are taken, together with others of similar nature in the results of four preceding exercises of the same character, I think I am justified in asserting that the superiority of lip-touch-reading over lip-reading ranges from 30 per cent to more than 100 per cent in the case of subjects who have had systematic training in the aggregate of at least 120 hours. I say 120 hours because when we made our first test in which we discovered such results as I have been reporting, not one of our subjects had had an aggregate of more than 120 hours of laboratory training and all in a great variety of exercises. If we can, in another year, make as much improvement in our technic as we have made in the last six months, I

am confident that we shall be able to make as good a showing as we have now done but in very much less time.

The reasons for the superiority of lip-touch-reading are chiefly two. In the first place, many words that cannot be distinguished as they are seen on the lips can be discriminated by their feel. This I have already referred to in my remarks about homophenous words. There are probably upward of 2,000 of them in the English language. Of these, I have taken 307 at random. They occur in 131 groups. Within each of the 131 groups there are from two to ten words. When they have been read into the fingers of my subjects three times to acquaint them with the tactual correlates of the words, they can immediately thereafter identify them with a high degree of accuracy. Indeed in my test on this point, I found that there were only seven groups among the 131 in which we failed to find from six to ten identifications in ten trials. Obviously, therefore, touch can be made to supplement vision as means for interpreting spoken language.

The second reason for the superiority I have referred to is found in the fact that, by means of the tactual impressions of vocal language, deaf subjects may become familiar with the movement of speech, namely, phrasing, emphasis and rhythm. These are characteristics that normally hearing people have casually learned to connect up with meanings, so that in their experience the swing of speech supplements the auditory impression of the successive words as words. The deaf undoubtedly do an analogous thing as a consequence of feeling speech through its vibration against the skin.

CORRECTION

The last word in Dr. E. Lee Myers' discussion of the paper by Drs. Moersch and Conner, "Hysterical Dysphagia," in the August issue of the ARCHIVES OF OTOLARYNGOLOGY, p. 118, should read "psychically," instead of "physically."

Clinical Note

EPHEDRINE IN NASAL DISTURBANCES

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In a recent publication by William S. Thomas,[1] on a new and valuable drug in the treatment of asthma, he describes a drug, ephedrine, which is the alkaloid of the plant *Ephedra vulgaris*. The latter is one of the multiple drugs used for centuries by the Chinese in a tea which had a satisfactory effect in the relief of an asthmatic attack. The alkaloid ephedrine has an action similar to epinephrine, but its effect is several times as lasting. Its action in the relief of an asthmatic attack is attributed to a vasoconstriction in the bronchial mucous membrane, which diminishes the amount of secretion and the edema of the mucous membrane, thereby increasing the lumen of the air passages. The bronchoscope has proved that there is a blanching of the mucous membrane after the administration of this drug.

It was concluded that if ephedrine had such a specific effect in the vasoconstriction of the bronchial mucosa, it should have a similar effect in the mucous membrane of the same system nearer its termination, namely, the nasal mucous membrane. A three per cent solution used as a spray was found to cause a vasoconstriction in the nasal mucous membrane, which in a case of hay-fever persisted for over twenty hours. Unlike epinephrine, it did not cause sneezing nor a compensatory relaxation following its use.

In the treatment of nasal conditions, it is of decided value in shrinking the nasal mucous membrane, especially in the palliative treatment of an acute sinusitis, when drainage is desired. In acute coryza, the congestion is relieved for hours and the increased aeration affords considerable relief, not only by the evaporation of the secretion but probably by shortening the course of the infection. In cases of hypertrophic rhinitis, the condition is greatly improved by the contraction of the vascular structures, which permits freer drainage of the sinuses, together with an increased aeration of the nasal passages.

1. Thomas, W. S.: J. M. Sc. **71,** no. 5.

PROGRESS IN OTOLARYNGOLOGY

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

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ACUTE AND CHRONIC OTITIS MEDIA AND SINUS THROMBOSIS*

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SCOPE OF SUMMARY

Acute and chronic middle ear suppurations and sinus thrombosis furnished relatively few articles in 1925 which fall within the standards set for a summary. To enumerate all the articles and the journals in which they appeared would be but another way of publishing an index, accompanied by a very contracted abstract. An article, to come within our purview, must either contain original matter based on scientific observation, or must add clinical data to some moot or controversial question confronting otolaryngology. Case reports are omitted unless they shed added light on unsettled clinical aspects of a lesion, and reports on therapy are limited as far as possible to a discussion of such as contain comparative studies, so that the reviewer may quote the advantages of the advocated method over those measures heretofore employed and in general usage.

ACUTE PURULENT OTITIS MEDIA

Experimental.—Smith and Webster [1] detail their findings in cases of otitis media resulting from experimentally produced respiratory infections in rabbits. By introducing *B. lepisepticum* into the nares of 102 rabbits, they produced a respiratory infection called "snuffles." At necropsy, 32 per cent of the animals were found to have purulent otitis media. It is at once noteworthy that the majority of the animals subjected to the experiment escaped middle ear infection We can accept the observers' conclusion that a pathologic agent introduced into the nose may easily involve the entire adjoining group of cavities—the paranasal sinuses and the middle ear spaces—but they fail to account for the absence of infection of the middle ear in 68 per cent of the

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* From the Otolaryngological Department of Beth Israel Hospital.

1. Smith, D. T., and Webster, L. T.: Epidemiological Studies on Respiratory Infections of Rabbits: Etiology of Otitis Media, J. Exper. Med. **41**:275, 1925.

animals. In this regard, Swain [2] pointed out the salient factor in protecting the middle ear spaces; that is, the rôle played by the ciliated epithelium which is found in the paranasal sinuses and on the surface of the eustachian tube. The observations of Smith and Webster as well as those of Swain still leave undemonstrated the particular factor or element which breaks down the protective mechanism. Brown's [3] suggestion is noteworthy, namely, that in the presence of normal ventilation bacteria entering the eustachian tube are deposited near its orifice, because of the slow character of the air changes in the tube, and are kept within physiologic bounds by the ciliatory action of the epithelium. However, we still regard the mechanics of invasion of the middle ear spaces from the nares and nasopharynx in man as an unsolved problem.

Ross [4] has made some interesting studies on the etiologic relationship of scarlet fever to otitis media purulenta. Over a period of ten years, 2,514 cases came under his observation. Otitis media purulenta developed in an average of 14.24 per cent of the cases. The outstanding feature of Ross' report is found in the observation that none of the complications of scarlet fever—nephritis, myocarditis, ulcerative tonsillitis and arthritis—appeared to be responsible for the ear condition, nor did the latter predispose the patient to these complications.

This observer favors the view that the otitis media is primarily a result of the scarlet fever in the middle ear, often aggravated by secondary infection through extension from the throat along the eustachian tube. The lining membrane of the middle ear spaces desquamates, and a local irritant is thus produced which furnishes the soil on which the infection takes root.

In measles, Tobertz [5] contends that the exanthema affects the eustachian tube and the middle ear spaces more particularly. These areas are, however, affected independently of each other. The mucosa of the tube is first involved, most often before the appearence of the rash on the body. Tobertz holds that the exanthema appears as such in the tympanic cavity, too, before the appearance of the body rash.

The relationship of general constitutional factors to the etiology of otitis media engaged the research of Albrecht,[6] who concludes that there

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2. Swain, H. L.: Ann. Otol. Rhinol. & Laryngol. **33**:1299-1306, 1925.

3. Brown, Frank E.: A Study of the Eustachian Tube with Special Reference to the Recognition and Preservation of Its Delicate Function, Northwest M. J. **24**:25-29 (Jan.) 1925.

4. Ross, Ellison L.: Otitis Media in Scarlet Fever, Ann. Otol. Rhinol. & Laryngol. **33**:1319-1326, 1924.

5. Tobertz, A.: Clinical Experiences in Diseases of the Ear and Upper Air Tract, Complicating the Commonest Infectious Diseases, Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **21**:27, 1924.

6. Albrecht, W.: Pneumatization and Constitution, Ztschr. f. Hals-, Nasen- u. Ohrenh. **10**:51, 1924.

is a decisive influence to be found in the constitution of an individual on the origin, development and course of otitis media. The constitutional factor is found to reside in the hereditary tendency to inflammation in general. Albrecht cites several human pedigrees to support his observation, in which a dominant heredity of middle ear suppuration could be followed through three generations. He finds that atypical middle ear suppuration occurs most often in female patients afflicted with exudative diathesis in their youth, and, of course, in children subject to repeated attacks of chronic middle ear catarrhs and otitis media.

The work of Doyle [7] becomes important as having a bearing on the constitutional diathesis. He studied the possible relationship of fat-soluble vitamin A deficiency to purulent conditions in the nose and ears of rats. His observations accord with those of Daniels, Armstrong and Hutton,[8] who frequently remarked on purulent material in the paranasal sinuses, middle ears and mastoid cells of rats which had been kept on a diet deficient in vitamin A for from six to eight weeks. Doyle is impressed with the fact that rats which are subnormal as the result of being kept on a vitamin deficient diet generally present purulent middle ear conditions. The conclusion arrived at by Findlay [9] and Werkman,[10] and agreed to by Doyle, is that there occurs a general decrease of resistance to bacterial infection during avitaminosis, including vitamin B deficiency. Translating these conclusions to their analogy in man, the observations of Albrecht [6] are comprehensible. He finds that the greatest number of chronic middle ear suppurations occur in children wrongly nourished in infancy.

Hand in hand with constitutional diathesis, Albrecht [6] found the pneumatic development of the mastoid process as a factor in etiology. In ten subjects with a normal mucosa, he invariably found a normally pneumatized mastoid process. Among twenty subjects having an exudative diathesis, twelve showed inhibitions to complete pneumatization and five had reduced pneumatization, while only three were normal in this regard. In these studies Albrecht conveys the impression that transmitted changes, as from chronic nasopharyngeal catarrhs and enlarged tonsils, affect pneumatism. In this way he is able to link our previously acquired knowledge of etiology to a more definite factor, and we gain

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7. Doyle, L. F.: Head Pathology During Avitaminosis, Ann. Otol. Rhinol. & Laryngol. **34**:901, 1925.

8. Daniels, Amy L.; Armstrong, Margaret E., and Hutton, Mary K.: Nasal Sinusitis Produced by Diets Deficient in Fat Soluble A Vitamin, J. A. M. A. **81**:828 (Sept. 8) 1923.

9. Findlay: J. Path. & Bact. **26**:1 (Jan.) 1923; ibid. **26**:475 (Oct.) 1923.

10. Werkman: J. Infect. Dis. **32**:255, 1923.

a more exact understanding of the finer elements in the etiologic chain in the development of the purulent otitides.

In another communication, Albrecht [11] makes deductions which have a bearing on the course of otitides. In twenty-four cases of chronic bone suppuration, twenty-three cases of chronic mucosal suppuration and fifty-eight cases of acute middle ear suppuration, his study of the element of pneumatization of the mastoid process tends to support the contention of Wittmaack that normal pneumatization insures easy, uneventful healing, whereas inhibited pneumatization entails a pronounced tendency toward chronicity. The use of roentgenograms in prognosis is possible if these observations are kept in view.

Bacterial Flora.—Many have advocated a detailed study of the bacterial flora from the middle ear in the acute otitides. The importance of such studies is emphasized when a specific organism is demonstrated to be present in the otorrhea. Too often the clinical picture is not characteristic, and the specific therapy indicated is passed by because the organism presented is not demonstrated. This is brought out by Friesen,[12] who reports two cases of primary diphtheria of the middle ear. In the clinical picture were extreme toxemia, chills and high temperature. Myocardial symptoms were also present. Cultures and smears from the aural discharge gave the specific diagnosis, and on administration of diphtheria antitoxin prompt remission of the symptoms ensued.

Study of the bacterial flora from the otitic discharge has enabled Abrahams and Banoff [13] to subdivide cases of middle ear suppuration caused by *Streptococcus mucosus* (pneumococcus type III) into four groups, as follows: (*a*) Mastoiditis without middle ear involvement; (*b*) mastoiditis with short-lived middle ear involvement; (*c*) acute middle ear lesions which heal but which subsequently result in intracranial complication, and (*d*) cases which run an uneventful course to recovery.

Such a classification does not aid the situation when the otologist is confronted with a given case wherein *Streptococcus mucosus* is demonstrated in the otorrhea. Granted that the given case will run one of the four clinical courses that Abrahams and Banoff outline, these observers have still not furnished data by which the clinician can foretell which of the four courses his particular case is going to take. Because of the uncertainty as to the clinical outcome of otitides of *Streptococcus mucosus*

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11. Albrecht, W.: Middle Ear Suppuration and Pneumatization of the Mastoid Process, Ztschr. f. Hals-, Nasen.- u. Ohenrh. **10**:55.

12. Friesen, J. F.: Primary Diphtheritic Otitis Media, Laryngoscope **35**:545.

13. Abrahams, B. H., and Banoff, Z. A.: Streptococcus Mucosus as an Etiological Factor in Otitis Media and Mastoiditis, Ann. Otol. Rhinol. & Laryngol. **34**:554, 1925.

origin, the work of Abrahams and Banoff is welcome as additional knowledge, but the main factor in this otitic infection—the elements by which the otologist may distinguish the case which will resolve permanently from that which will resolve only to be followed by a streptococcus meningitis—is still unknown.

Two new conceptions have appeared in regard to the clinical pathology of acute middle ear suppurations. One concerns the formation of polyps in cases of acute otitis; the other deals with the formation of cholesteatoma in acute middle ear suppurations, and even when such suppuration is wanting, that is, in subjects with intact membrana tympani. Both conceptions are subjects for analytic comment.

Seydell [14] reports two cases wherein polyps were found in the presence of acute middle ear suppuration. He considers this a rare finding, because usually a prolonged suppuration has been held necessary to excite polypoid growth. Here there is some confusion in the distinction between "acute" and "chronic" suppuration. As long as "acute" is taken to designate a suppuration of short duration and "chronic" is understood to imply a long one, the report of a polyp in a suppuration of short duration will be noted as a rare and unusual occurrence. When, however, acute and chronic middle ear lesions are understood to be pathologic entities having no relation to time, then the pathogenesis of a polyp in a case of short duration will hardly call forth comment. There are clinical entities which are comprehensible as chronic middle ear suppurations because of their characteristic features, and they are chronic lesions from the time of their onset. Among such, the finding of a rapid polypoid degeneration of the lining membrane of the middle ear is not uncommon. Aside from excrescences from the lips of the perforation in the membrana tympani, which, pathologically considered, are not true polyps at all, and to which a closer reading of Seydell's report would relegate the lesion he describes, the location of the perforation through which the polyp presents, the etiologic factors and the invading organism play important rôles in the development of aural polyps, and the classification of the case into the acute or the chronic group.

Regarding cholesteatoma in acute cases, Lange [15] reaches the conclusion that a cholesteatoma can develop after any inflammation in the tympanic cavity. Usually the epidermis migrates through large perforations of the membrana tympani, and the mucosa, denuded of its epithelium, is epidermized. This is the process usually observed in the chronic suppurative lesions. Lange, however, states that the epidermis

14. Seydell, E. M.: Ear Polyps in Acute Otitis Media, Ann. Otol. Rhinol. & Laryngol. **34**:925 (Sept.) 1925.

15. Lange, W.: Concerning the Origin of Cholesteatoma of the Middle Ear, Ztschr. f. Hals-, Nasen- u. Ohrenh. **11**:250 (June) 1925.

may emigrate without any perforation of the membrana tympani if there is no resistance in the membrana flaccida. This atypical exuberation of epithelial growth is based on a proliferating inflammation. He cites the cases of Manasse as showing that a cholesteatoma may form, leaving an entirely intact drum membrane after the inflammation which released the migration of epithelium has healed. Elsewhere in this summary, attention has been directed to the effects of pneumatization of the mastoid process on suppurative middle ear lesions. To Lange it seemed that pneumatization furthers the growth of cholesteatoma. He observes its effect to be confined to the age of pneumatization—the first years of life—and in this he is in accord with Wittmaack. Speaking of the mechanics of development, he says that if a cholesteatoma develops in the first year of life, it encounters in the middle ear spaces a physiologic process which represents a breaking up of the bone by the subepithelial growth of epithelium tissue; that is, the first act of pneumatization. The growth of epithelium is very marked at this time; and the second act of pneumatization, the secondary wall formation of the cell, is suppressed through the growth of the epidermal cyst. The surprising extent of cholesteatomas in infancy, which has repeatedly led them to be considered congenital tumors, is explained by Lange on the assumption of an inflammatory genesis supported by normal pneumatization. On the one hand Lange reiterates that a chronic suppuration is not the condition sine qua non for the formation of a cholesteatoma, but on the other he states that a drum membrane may be intact if a proliferating inflammation of long duration is present. This is a confusing statement, because he defines cholesteatoma as a cystic or cyst-like growth of epidermis on an inflammatory basis.

While Lange is in accord with the accepted view in regard to the formation of cholesteatoma from a chronic suppuration with a defective membrana tympani, his elaborate study is concerned mostly with what we have heretofore regarded as congenital cholesteatomatous growths. If we assume, as he does, a chronic inflammatory basis for these, his theory of cholesteatoma as a result of acute middle ear suppuration becomes untenable, and the older, accepted view of the development of cholesteatoma still holds.

The question of the intact tympanic membrana is intriguing. Perhaps the explanation of this is contained in Ruttin's [16] minute study of the membrana tympani, in which he found a slit constantly present in the membrane, leading to a recess in the middle ear space that forms part of the pocket of von Troeltsch's space. The early observers, such as Politzer, have described isolated purulent processes in these spaces, and

16. Ruttin, Erich: Zur Anatomie des Trommelfells, Acta oto-laryng. **7**:349, 1925.

perhaps these are the origin of the type of cholesteatoma in question, and this normal slit the point of entrance to the middle ear spaces.

Nager [17] states that there are differing opinions regarding the origin of cholesteatoma; and while reports of congenital cholesteatoma have been recorded, he found none such among records numbering about 100,000, in Munich, Bale or Zurich. The report of Ruttin [18] and other observers who base their classification of a cholesteatoma on the presence or absence of elastic fibers in the cholesteatomatous matrix is, in Nager's opinion, unconfirmed. He therefore holds it very difficult to prove that a cholesteatoma is really congenital in origin. At any rate, we can accept Nager's conclusion that such an observation would be such a rarity as to lose all practical importance. In an extensive clinical practice, covering many years of service in large institutions, my experience has been such that I tend to accept Nager's point of view. I have never seen a congenital cholesteatoma nor one with an intact membrana tympani although I have known of reports to the contrary by competent observers.

CHRONIC PURULENT OTITIS MEDIA

The tuberculous lesions of the middle ear spaces continue to occupy attention abroad. M'Cart [19] finds that the bovine variety was the causative agent in three-quarters of all the cases in children, in whom a definite diagnosis of a tuberculous otitis had been established by animal inoculation and cultural methods. This finding is attributed to the general use of unboiled milk in Europe. It is interesting to note, in passing, that among these children with tuberculous otitides, 39 per cent of the patients had a facial paralysis in their symptom complex. None of the adults in M'Cart's series presented facial paralysis.

Since Nakamura [20] found that 23.75 per cent of his cases, in a series of eighty chronic otitic purulencies, gave the tubercle bacillus as the causative agent, he advocates animal inoculation and cultivation as the only method of isolating the organism from the purulent discharge; and he stresses the necessity of making such a search in every case of prolonged purulency, regardless of the clinical picture.

The relationship between tuberculous otitis media and the formation of cholesteatomata of the middle ear is touched on by Nager,[17] who cites the work of Hegetschwiler in Bezold's Clinic. He states that histo-

17. Nager, F. H.: The Cholesteatoma of the Middle Ear, Ann. Otol. Rhinol. & Laryngol. **34**:1249, 1925.

18. Ruttin, Erich: Ztschr. f. Hals-, Nasen- u. Ohrenh. **10**:59, 1924.

19. M'Cart, H. D.: Tuberculous Disease of the Middle Ear, J. Laryngol. & Otol. **40**:456 (July) 1925.

20. Nakamura, M.: Tubercle Bacilli in Otitis Media, Ztschr. f. Tuber. **42**:189 (April) 1925.

logic examinations have shown that tuberculous otitis media forms an especially favorable soil for epidermidization or cholesteatomatous formation. In such instances, the cholesteatome formation is to be considered as a healing process, although danger resides in the possible accumulation and putrid decomposition of the epidermic scales, and in the fact that the growth takes place at the cost of its environment.

In America, we have not yet established the frequency of tuberculous otitis. It is probably rare, although cases are on record (Hayden and Cohen [21]), and it is also a fact that we see comparatively few true cholesteatomatous cases. If the observations of Ulrich, cited by Nager, are true, that is, that in 42 per cent of cholesteatomas a proved tuberculous affection could be established, the rarity of both lesions in our clinical experience becomes comprehensible.

DIAGNOSIS

The Fähraens blood sedimentation test has been advocated as a useful aid in diagnosis, particularly when acute suppurative processes come into question. The test is a nonspecific, biologic reaction of accelerated sedimentation, and the reaction occurs whenever there is marked protein distintegration and reabsorption. Bertog [22] finds it useful, particularly in inflammatory suppurative processes. He finds that the accelerated sedimentation parallels the extension and severity of the inflammatory process.

The technic necessitates the use of a 2 cc. syringe, containing 0.4 cc. of a 2.5 per cent sodium citrate solution. Blood is withdrawn from a vein to fill a syringe. The blood and sodium citrate are thoroughly mixed and centrifuged, and then withdrawn into a 1 cc. pipet of 3 cc. bore and placed on a stand. The sedimentation takes place in the pipet and the result is read in three-quarters to one hour. Bertog's observations coincide with those of others, that sedimentation increases as the inflammatory process advances. He found the test useful in all acute suppurative conditions, including those of the middle ear, and advocates its employment in doubtful cases which seem on the borderline and when a decision must be made whether to proceed to operative intervention or to continue conservative therapy.

Finally, the test should be repeated at intervals so as to get a serial reading. This gives it enhanced value. This test might be found useful as an additional laboratory aid, particularly in cases in which the clinical picture is mild, or when, as in diabetes, the constitutional diathesis

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21. Hayden, D. B., and Cohen, A. I.: Tuberculosis of the Middle Ear with Report of a Case, Laryngoscope **35**:883 (Dec.) 1925.

22. Bertog, Johannes: The Fähraens Blood Sedimentation Test in Otorhinolaryngology, Ztschr. f. Hals-, Nasen- u. Ohrenh. **10**:28 (Nov.) 1924.

overshadows the otitic picture and modifies the findings. To know that a suppurative process is progressing despite mild clinical manifestations, would be a helpful item in determining the necessity for surgery.

THERAPY

Schwartz [23] reports very good results in the treatment of acute otitis media from the use of a combination of chemical agents which destroy, first the gram-positive and then the gram-negative, organisms in the middle ear. The method is based on the principle of staining the organisms in vivo, and, by staining, killing them. It consists of thoroughly cleansing the external auditory canal and then instilling a solution of meroxyl and acetic acid. This is presumed to act on the gram-negative bacteria. After an interval, the canal is again dried and a combination of gentian violet and neutral acriflavine is employed to fix the gram-positive organisms. It is claimed for this method that it obviates the necessity for home treatment by irrigation, shortens the duration of the aural discharge and tends to prevent mastoiditis. Statistics of comparison, showing the results in similar cases treated in the ordinary way by irrigation, are lacking in his report.

To me, it is not entirely clear how the chemicals get into the middle ear spaces to attack the active bacterial flora which produce the otitis. It is conceded that one can render the external auditory canal more sterile by this method, but in acute lesions the middle ear spaces contain pus coming away under considerable pressure through a perforation whose edges are usually swollen and edematous and almost always in apposition. We recall experiments made by Prof. Fritz Grossman of Professor Lucas' Clinic in Berlin in 1904, at which I assisted, but which, as far as I know, were never published. These were experiments in hydraulics, with colored fluids placed in a bucket and raised to a considerable height above the cadaver's head. The tube conveying the fluid from the bucket was sealed, air tight, into the external auditory canal at the concha, while the membrana tympani was freely incised. At no height at which the pressure could have been borne by a living patient could the colored fluids be introduced into the recesses of the tympanic cavity. In these cadavers the middle ear contained neither pus nor other obstructing fluid. It was the air contained in the structures which acted as the obstructing factor. In the cases reported by Schwartz, the pus in the middle ear, to say nothing of the air in the deeper structures, would have to be withdrawn before the chemicals he employs, which have a different specific gravity and a different surface tension, could mix freely with

23. Schwartz, E. M.: Chemotherapy in Otitis Media, Ann. Otol. Rhinol. & Laryngol. **34**:932 (Sept.) 1925.

the viscous middle ear exudations present in an acute purulency, so as to stain the living organisms in living tissues and kill them.

Kobrak [24] advocates what he designates as stimulation therapy in those forms of acute middle ear infection which drag on for weeks with slight secretion and reaction, or with occasional periods of cessation of the discharge. By stimulation therapy he means the administration of stimuli to a desired site. His method consists of: (1) Parenteral stimulation therapy by specific vaccines and nonspecific proteins, and (2) peroral administration of substances that have not been sufficiently studied to warrant an authoritative opinion as to their exact therapeutic value. This author is extremely cautious in outlining the indications for stimulation therapy, and wisely suggests a careful selection of cases for submission to this treatment. He deprecates indiscriminate injection in all possible cases that do not heal otherwise. There seems no doubt but that there is room in our therapeutic armamentarium for nonspecific protein therapy.

The conservative treatment of chronic aural suppuration engaged the attention of Haskin,[25] who summarizes his experience and observations over a period of twenty-nine years of work at the Manhattan Eye, Ear, Nose and Throat Hospital in New York City. In a tabulation of 800 cases of chronic aural suppuration, he found indications for radical mastoidectomy in only twenty-one. In private practice, he states, he has never encountered a necessity for the radical surgery. Haskins considers the removal of tonsils and adenoids imperative in all ear cases, and advocates a careful study of the secretions in all cases to determine the presence or absence of bone caries or tuberculosis and to elicit whether the discharge is mostly mucus, which would indicate tubal and membranous disease. Polyps are eradicated when present, and the ear is cleansed of all secretions. Haskins employs a culture of *B. bulgaricus*, placed in the external auditory canal and kept there for twenty minutes, to help in restoring a healthier condition to the membranes. If ossicles are carious, he removes them, but when he finds areas of caries, it has been his experience that they often heal on the instillation of enzymol with its dilute hydrochloric acid component. When the eustachian tube is at fault in maintaining the suppuration, he irrigates with mild silver protein (argyrol) or neosilvol solution. He has had most success by removing all secretions, and then attempting sterilization of the region with 75 per cent alcohol solution, drying with a current of air at low pressure and then treating the cavity with a dusting powder. He advo-

24. Kobrak, F.: Indications for Stimulation Therapy in Otiatrics, Ztschr. f. Hals-, Nasen- u. Ohrenh. **10**:41 (Nov.) 1924.

25. Haskin, William H.: Ann. Otol. Rhinol. & Laryngol. **33**:1272-1286 (Dec.) 1924.

cates that the ear should be treated by the physician and not left to the care of the patient or his family.

Haskins' article is noteworthy because of the large amount of material handled and the generally good statistical results. What are lacking are definite statistics within each group and class of case subjected to any particular method of treatment, and the time within which each class of case yielded to a given procedure.

Shambaugh [26] treats certain fallacies in the conception of the treatment of chronic aural suppuration which are worthy of comment. He outlines the relationship of anatomic variations in the nose to chronic aural suppuration and believes that these aberrations are much overrated as causal factors in the aural suppurations. As far as anatomic variations are concerned, I agree with Shambaugh; but conditions other than obstructive, namely, infectious lesions, may play a prominent causal rôle in the chronic aural suppurations, as indicated by Syme,[27] and these should never be overlooked.

It is interesting to note Shambaugh's differentiation between the dangerous and the nondangerous types of chronic otitis media and to second his statement of the indications for radical mastoid surgery. He emphasizes that the radical mastoid operation is undertaken, not to stop a chronic otorrhea, but to eradicate a lesion; and it is immaterial whether or not a degree of otorrhea persists as long as the surgery has removed the threat to life by rendering the lesion less apt to produce a fatal intracranial complication. Frey [28] also comments on the dangerous and the nondangerous types of chronic purulent otitis. He is interested in the life insurance angle of the question and lays down the factors which make for this differentiation. In the main, he is in agreement with Shambaugh and many other observers (Kopetzky [29]), when he points out that those cases which present marginally located perforations are usually of the dangerous type; and he therefore considers them bad insurance risks. Finally, in considering the types which may be classed as dangerous, it is well to recall that Scheibe [30] considers the cholesteatomatous otitides as the most dangerous of all. He found this lesion

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26. Shambaugh, G. E.: Clinical Problems of Chronic Suppurative Otitis Media, Laryngoscope **35**:593 (Aug.) 1925.

27. Syme, W. S.: Pathologic Conditions in Nose and Throat in Relation to Aural Suppuration, Brit. M. J. **2**:999-1000 (Nov.) 1924.

28. Frey, H.: Ear Diseases and Life Insurance, Med. Clin. **21**:761 (May 22) 1925.

29. Kopetzky, Samuel J.: The Indications for the Radical Mastoid Operation Based upon Pathologic Lesions, Ann. Otol. Rhin. & Laryngol., March, 1909; ibid. June, 1910.

30. Scheibe, A.: Diagnosis of Cholesteatomatous Perforations, München. med. Wchnschr. **72**:713 (May) 1925.

responsible for the fatal outcome of half of 169 cases of chronic otitis studied by him.

Almour,[31] in a paper on the conservation of hearing in suppurative otitic cases, cautions against the use of suction in the treatment of purulency of the middle ear because of the loss of hearing which results from this procedure. Repetition of incision of the membrana tympani also comes in for condemnation as a measure which, while occasionally useful in temporarily warding off more severe surgical intervention, is a menace to the hearing faculty because the repeated paracenteses handicap the drumhead in its return to normal.

In the management of cases tending toward chronicity or having the elements of chronicity, Almour, and Blalock and Crowe,[32] as well as others,[33] advocate the performance of the simple mastoid operation rather than the radical mastoidectomy. They maintain a persistent postauricular opening to permit treatment to the antral region, and keep this tract open until the middle ear spaces have completely dried and the otorrhea has ceased. Then a secondary plastic operation is performed to close the tract. For this procedure Blalock and Crowe contend that it conserves the hearing, which they found increased in acuity in 60 per cent of their cases and without further loss in 38 per cent. The otorrhea ceased in 33 per cent, became slight in 45 per cent and was uninfluenced in the remainder of their cases. My experience with this procedure commends it as a conservative measure, which often cures subjects who otherwise would have been subjected to radical mastoid operation.

SINUS THROMBOSIS

Among the many reports on sinus thrombosis, all of which are interesting from the clinical standpoint, that of two cases of primary bulb thrombosis, not in infants, by Ginsberg,[34] is particularly noteworthy because of the rarity of the lesion under such circumstances. One case involved an adult, aged 19, the other a child of 8 years. The occurrence of primary bulb thrombosis among infants is not so uncommon as to require comment, and similar factors may conceivably produce the same lesion in adults. Ginsberg draws attention to this type of thrombosis, which may occur with or without the presence of an accompanying mastoiditis, and lays the factor in its development to direct extension

31. Almour, Ralph: Conservation of Hearing, M. J. & Rec. **120**:178 (Dec. 17) 1924.

32. Blalock, A., and Crowe, S. J.: Treatment of Chronic Middle Ear Suppuration, Arch. Otolaryngol. **1**:267 (March) 1925.

33. Kopetzky, Samuel J.: Otologic Surgery, New York, Paul H. Hoeber, Inc., 1925, pp. 104 and 148.

34. Ginsberg, William: Two Cases of Primary Bulb Thrombosis, Not in Infants, Laryngoscope **35**:800, 1925.

of the infection from the middle ear through dehiscences in the bony floor of the tympanic cavity to the dome of the jugular bulb.

The most noteworthy contribution to the question of diagnosis in sinus thrombosis last year is to be found in the perfection of a method of determining the side involved in a thrombosis in cases of bilateral mastoidal suppuration. In April, 1925, Dowman [35] contributed a short article, and in July, 1925, Tobey and Ayer [36] published an account of practically the same procedure. This procedure consists of introducing a Quincke needle into the spinal column. This needle is attached to a manometer of 2 mm. bore. The spinal fluid is permitted to run into the manometer and the pressure at which the cerebrospinal fluid stands is noted. Pressure is then exerted over one internal jugular vein, and the pressure of the fluid in the manometer is again noted. If there is no obstructing thrombus present, the fluid in the manometer will rise. If, on the other hand, an obstructing thrombus is present in the side tested, there will be no appreciable change in the height of the fluid in the manometer. Slight variations are apt to be noted, but the difference between the two sides is sufficiently marked to add valuable data toward determining the side involved. In practice, when a mural nonobliterating thrombus fails to shut off the venous blood channels entirely, the differences in the readings obtained from the two sides are less striking. In unilateral sinus thrombosis, these manometer readings are of value, also, in establishing the pressure of a clot in the venous channels.

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35. Dowman, C. E.: A Simple Test for the Diagnosis of Thrombosis of the Lateral Sinus, J. A. M. A. **84**:1268 (April 25) 1925.

36. Tobey, G., and Ayer, J. B.: Dynamic Studies on Cerebrospinal Fluid in the Differential Diagnosis of Sinus Thrombosis, Arch. Otolaryngol. **2**:50 (July) 1925.

Abstracts from Current Literature

Ear

CARTILAGE VESSEL SYSTEMS AND OTOSCLEROTIC AREAS. ECKERT MOEBIUS, Ztschr. f. Hals-, Nasen- u. Ohrenh. **12**:654 (Nov.) 1925. (From the Transactions of the German Otolaryngological Society.)

The author refers to his previous work (volume 3, *Archives of Otology*). In the third and fourth embryonal month, perichondrium sprouts in the form of regularly formed cartilage vessel systems, push into the thicker layers of the (as yet) cartilaginous labyrinthine capsule and there start enchondral cartilage growth centers. They remain separated for a long time from the bony development growing inward from the surface, and show definite histologic evidence of more or less incomplete ossification.

The labyrinth capsule shows the following cartilage canal systems: (1) a large one of the fossa subarcuata and a neighboring smaller one of the fossa retroarcuata; (2) one in front of the oval window; (3) one in the angle between the canalis acousticus interna and the cochlea base (from the synarthrosis petrobasalis); (4) one which radiates from the floor of the tympanic cavity in front of the round window (shown in illustration).

He calls attention to the fact that these are the sites of predilection for otosclerotic areas; i. e., that otosclerosis develops in those areas which most frequently show late or incomplete ossification, and argues that these otosclerotic areas are related to definite vessel arrangement, and are not in the nature of tumor formation.

He calls attention to two biologically separate vessel systems, the primary cartilage canals and the secondary radiating bone vessels; between these two there exist, even to old age, incompletely ossified, poorly vascularized areas, and he assumes that these areas are more susceptible to metabolic disturbances. He also says that otosclerotic subjects show constitutional inferiority as indicated by blue scleras and fragile bones, and suggests three components in explanation of otosclerotic areas.

1. Constitutional: Disturbances of the mesenchyme, probably secondary to those of the internal secretions, or as a hereditary factor.

2. Local: In the borderland between the primary cartilage vessels and the secondary bony vessels, poorly vascularized, biologically inferior, metabolically unstable bone in the known predilection sites of otosclerosis changes.

3. Exciting components, general and perhaps local metabolic disturbances peculiar to females and to adolescence; the step-like course and aggravation during pregnancy, etc., noticed in the clinical picture of otosclerosis.

LEWY, Chicago.

CONCERNING THE PHYSIOLOGY OF THE EAR. W. TONNDORF, Ztschr. f. Hals-, Nasen- u. Ohrenh. **14**:406 (April 27) 1926.

Tonndorf takes issue with the theory advanced by Specht. Specht thinks that the sense cells react differently to changes in pressure which vary in rapidity. The increase of pressure causes a certain reaction which is abolished

by decrease in pressure, so that the irritation of the nerve is propagated by the same cell. It must be assumed that the short pressure times of high tones do not act on the sense cells which are tuned in for the deeper tones, whereas the increase in pressure of deep tones proceeds so slowly that a reaction cannot be produced in the cells which respond to quick impulses.

Tonndorf states that Specht has a wrong conception of the pressure of a sound wave. The inner ear does not react to pressure, but to motion. Tonndorf claims that the theory of Specht concerning sound perception in the labyrinth is nothing else but a modification of the theory of resonance of Helmholtz, with which Specht takes issue. Tonndorf quotes the physicist Waetzman, who stated, that in spite of some difficulties, really decisive objections do not exist at present against the theory of resonance and that this theory has provided excellent results in a positive manner.

AMBERG, Detroit.

Pharynx

HEMOLYTIC STREPTOCOCCI IN THE PHARYNX AND TONSILS OF INFANTS AND CHILDREN. I. PILOT and HARRISON TUMPEER, Am. J. Dis. Child. **31**:22 (Jan.) 1926.

The authors, in a bacteriologic study of operated and unoperated throats of children, aged from 6 to 15, found hemolytic streptococci present in 97 per cent of the excised tonsils, and in 61 per cent of cases of simple hyperplastic tonsillitis.

In adults, these organisms were found four times as frequently in non-operated as in operated throats.

Swab cultures of comparatively normal throats of children, aged from 6 to 15 years, demonstrated hemolytic streptococci in 55 per cent of cases. They were present in 61 per cent of extirpated adenoids.

Further studies in children under 6 years of age, afebrile, and presenting a simple hypertrophic tonsillitis without fibrosis, showed hemolytic streptococci in 89 per cent of excised tonsils and in 55 per cent of extirpated adenoids. Cultures from the tonsils of normal children, aged from 6 weeks to 10 years, were positive in 47 per cent of cases.

The authors conclude that these organisms are normal inhabitants of the throat, residing principally in the crypts of the tonsils.

Their studies demonstrate the fact that hemolytic streptococci are present more frequently and in larger numbers in the depths of the folds and in the crypt-like depression, both in the tonsil and in the adenoid. They are frequently associated with organisms commonly present in the nose and throat, viz: *Streptococcus viridans,* pneumococcus, hemolytic and nonhemolytic staphylococcus, diphtheroids, and gram-negative cocci.

Injections of broth cultures into rabbits produced purulent arthritis and thrombo-ulcerative endocarditis of the mitral and aortic valves, with multiple infarcts of the spleen and kidney.

DIPHTHERIA FOLLOWING TONSILLECTOMY. ABRAHAM ZINGHER, Am. J. Dis. Child. **31**:72 (Jan.) 1926.

The author calls attention to the possibility of diphtheria occurring during convalescence from tonsillectomy, and the difficulty of its recognition during the presence of postoperative membrane in the throat. Infection may appear

and permanent damage may be wrought by the absorption of toxins before the complication is recognized.

There are several factors to consider in postoperative diphtheria: First, the general immunity to diphtheria; second, the local resistance of the mucous membrane; third, the presence of diphtheria bacilli in the throat; and last, local trauma, such as an operative procedure. General immunity to diphtheria may be investigated by the Schick test, a negative Schick test indicating a general immunity, which would probably prevent any postoperative infection, and a positive Schick test indicating, of course, a susceptibility to the organism and an increasing possibility of postoperative infection.

Local resistance of the mucous membrane is a factor, the exact character of which is unknown and which cannot, therefore, be determined. Some membranes have such resistance that diphtheria does not occur except in the presence of a local predisposing cause, such as an antecedent infection, tonsillitis, scarlet fever, chickenpox, or an operative trauma such as tonsillectomy, which may definitely lower the local resistance of the mucous membrane and render active a latent infection.

The organism may be present in the throat before operation but inactive due to general or local immunity, and may become active as a result of the operative trauma, or the infection may be superimposed directly on the operated field.

The author concludes that the best safeguard against diphtheria as an operative complication in nose and throat surgery is the active immunization of all young children with the new one-tenth L plus mixture of toxin antitoxin or diphtheria toxoid. Such immunity protects the patient from local infection and systemic intoxication from the toxin. All patients, whether carriers or not, who give a positive Schick test, should receive 1,500 units of diphtheria antitoxin before operation.

CONNOR, St. Paul.

ANGINA AGRANULOCYTOTICA. ULRICH FRIEDEMANN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **13**:473 (Jan. 18) 1926.

Tonsillitis is not always a local disease of the tonsil, but frequently only the symptom of a general disease. Diseases of the hematopoietic apparatus especially are frequently accompanied by grave affections of the tonsils. Grave necrotic tonsillitis occurs in acute or chronic leukemia, be it myeloid or lymphatic leukemia, whether the blood picture is leukemic or aleukemic. Serious necrotizing and gangrenizing processes in the tonsils occur also in Frank's aleukia. In this disease a complete destruction of all elements of the bone marrow, namely, of the white, of the red blood corpuscles and of the blood platelets is found. Clinically, a grave anemia and a pronounced hemorrhagic diathesis are evident. During the more recent years two additional general diseases have been added, namely, angina agranulocytotica and monocytic angina.

Schwarz of Vienna, in 1904, Tuerk in 1907, and Marchand in 1913, published descriptions of angina agranulocytotica, although not under that name. Schulz in 1922 reported a larger series of cases. Friedemann observed eight cases. In all, twenty-eight authentic cases have been reported. One of Friedemann's cases ran the following course. A woman, aged 30, was admitted Dec. 3, 1924, to the Rudolf Virchow Hospital. On November 24, a curettage had been done on account of abortion. No fever had been reported. November 28 the patient became suddenly sick; she complained of pain in the throat and had elevation

in temperature. A physician diagnosed bilateral tonsillitis resembling diphtheria. Three thousand units of antitoxin were given. When admitted, the patient appeared to be very sick and had a temperature of 102.2 F. The pulse was 104 and regular. The tongue was thickly coated, dry and fissured. The whole left tonsil was of a grayish green discoloration; the remainder of the pharynx was reddened. The gingiva was loosened and showed some pus. The heart, lungs, liver and spleen were normal. Diphtheria was assumed to have been present and a very large dose of antitoxin was given. A blood examination was made as part of the routine, as is done in all doubtful cases of tonsillitis. The erythrocytes showed a moderate decrease, the number of blood platelets were normal, 220,000, but a leukopenia was present. Besides this observation, it was surprising that no polymorphonuclear leukocytes were present, and only 100 per cent lymphocytes. The condition of the patient became worse during the following days, the temperature remained high, the necrosis in the throat progressed. It extended to he uvula and to the right tonsil. The left tonsil appeared to be a dirty greenish mass. December 7, the patient died with the symptoms of heart failure.

Such a fulminant course is not always found. Friedemann has seen conditions which lasted from two to three weeks, and had a patient for ten weeks under observation when he first published his paper. Some patients suddenly became very sick, others after a few weeks of malaise. In some instances the disease began with a severe tonsillitis, which developed in the course of a few days or weeks. The necrotizing processes are not confined to the tonsils. They can extend to the uvula, to the mucous membrane of the tongue, and to the larynx and trachea. Friedemann observed necrotic processes also on the tongue, on the mucous membrane of the palate, the gingiva, the uvula, the anus, the urethra, the skin of the femoral portion of the leg, and the small intestine. Petri saw necrotizing processes in the whole intestinal tract, the esophagus, the stomach, the small intestine and the colon. In some instances the tonsils are not affected. Sometimes a light icterus is found and an anemia which, however, is not very pronounced. Cases with thrombopenia do not belong here, but to another disease entity. No characteristic changes have been found macroscopically or microscopically in the organs, except the necrosis. There were no myeloid or lymphoid changes in the bloodforming organs as in leukemia. The bone marrow is not characteristic. Normoblasts, lymphocytes and megacaryocytes were normal in numbers.

Some observers have reported a decrease of myeloid elements in the red marrow of the ribs and vertebrae, but those findings were not characteristic. Of the twenty-eight patients described in the literature twenty-six were female. Female patients are more frequently subjected to diseases of the blood (chlorosis, essential thrombopenia 80 per cent pernicious anemia). The endocrine action of the ovaries must be of importance in this respect. Henning has shown that during menstruation, a considerable decrease of blood platelets can be observed. The prognosis is bad, although two patients recovered.

Therapy.—In one case the author thinks that neo-arsphenamine given intravenously was of some value. The general condition and the necrotic areas improved. The patient (female) died later of a secondary pneumonia. Another patient showed an improvement of the blood picture after injections of yatrencasein. Blood transfusion, however, is the most commendable procedure. In some instances microbes have been found in the blood, staphylococcus (Tuerk), streptococcus, and Friedemann found pyocyaneus in one instance. Friedemann did not find any microbes in six very carefully investigated cases. The acute

myeloblast leukemia with an aleukemic blood picture can produce similar disease pictures, but the clinical picture shows a severe anemia and hemorrhagic diathesis, which do not occur in agranulocytosis. Furthermore, pathologic forms of leukocytes, especially myeloblasts, are not found in angina agranulocytotica, neither is a pronounced decrease of blood platelets to be observed in the latter disease. On the contrary, they may be even increased in numbers.

More difficult is the differential diagnosis between angina agranulocytotica and the aleukemic final stage of lymphatic leukemia. A similar blood picture may be found, but in the latter a grave anemia is mostly present and the organs show characteristic changes. Still more difficult is the differential diagnosis between angina agranulocytotica and Frank's aleukia. In the former, only an injury of the granulocytic apparatus and a decrease of the white blood corpuscles is present, whereas Frank's aleukia is characterized by the absence of the blood platelets, and of the white and red blood corpuscles.

The monocytic angina (described by Bloedom and Houghton, Sprunt and Evans) has a favorable prognosis, therefore the differential diagnosis is of importance. The disease lasts from 3 to 4 weeks. The angina is of a more or less pronounced follicular type, or a dirty greenish or graybrown coating is found on the tonsils. The tonsils are very much swollen; the whole lymphatic apparatus is diseased; glandular swellings are found in the cervical cubital, axillary and inguinal regions. The spleen and liver are enlarged, and the blood shows about 80 per cent large mononuclear cells. Some American authors consider them to be large lymphocytes; Schultz thinks they are monocytes, because they give the oxydase reaction. The monocytes are gradually replaced by lymphocytes during the course of the disease. All stages of transition between the mononuclear cells and the lymphocytes can be found. Friedemann thinks they are juvenile forms of lymphocytes, and that the disease is a primary infection of the whole lymphopoietic system. He saw one patient, a girl with swelling of the glands and spleen, with the characteristic blood picture without tonsillitis. In conclusion, Friedemann urges the examination of the blood in all cases of tonsillitis of a doubtful nature.

AMBERG, Detroit.

Nose

PHLEBITIS OF SINUS CAVERNOSUS. HANS BRUNNER, Monatschr. f. Ohrenh. **1:2**, 1926.

Detailed macroscopic and microscopic study of the pathology of affections of the sinus cavernosus as a complication of otitis media disclosed the unusually high frequency of this complication. Of twenty-two consecutive ear cases coming to necropsy, twelve had an involvement of the sinus cavernosus. Brunner's observations (54 per cent) are supported by Sternberg, the *prosecteur* of the Vienna Polyclinic. The highest percentage heretofore reported was 16 per cent (Uta).

Other intracranial complications associated with cavernous sinus phlebitis resulting from an otitis media were: thrombosis of sigmoidal sinus, two cases; meningitis, seven, and three with meningitis and thrombosis of the sigmoid sinus. In two instances, therefore, no meningeal symptoms were present, the infection extending as far as the cavernous sinus without meningeal involvement.

The route of extension to the cavernous sinus is (1) through the sinus petrosus, (2) retrograde transportation of thrombi from the sinus sigmoideus and (3) through the veins of the plexus caroticus. The last mentioned route

is important in the causation of cavernous sinus trouble, especially when the middle ear suppuration ulcerates through the eustachian tube into the pericarotic structures. In those cases in which the cavernous sinus phlebitis is accompanied by a meningitis, the mode of infection of the sinus is either through the venae cerebrales inferiores, or the carotic venous plexus, or through caries of the apex of the pyramidal bone.

In the cases studied, abnormal eye observations were infrequent.

CHOANAL POLYP. KARL MENZEL, Monatschr. f. Ohrenh. **1**:56, 1926.

A heretofore unobserved sign of a nasal polyp extending into the epipharynx is mentioned. Anterior rhinoscopy alone permits the diagnosis of a choanal polyp if on speaking and swallowing the polypous mass, as seen anteriorly, possesses mobility. The explanation lies in the mechanical influence the soft palate and epipharynx exert during the act of deglutition and speech on a mass extending from the nasal cavity posteriorly.

GLOWACKI, Detroit.

THE TREATMENT OF CHRONIC SUPPURATION OF THE FRONTAL SINUS. TAPTAS, Ztschr. f. Hals-, Nasen- u. Ohrenh. **14**:418 (April 27) 1926.

Taptas makes a curved incision, which reaches from the outer edge of the eyebrow to the lower portion of the nasal bone. He then opens the anterior wall of the sinus in its lowest part immediately above the sutura frontomaxillaris. The opening is enlarged downward by resecting the suture and the ascending maxillary process until the lower third of the nasal bone is reached. Through this opening the ethmoid is reached. Under good illumination, if necessary, the middle turbinate is resected, and with the aid of fine curettes the ethmoid cells are opened. These are thoroughly cleaned with flat polyp forceps. Thus the sphenoidal sinus is reached, which also is opened and thoroughly curetted. If the frontal sinus is very broad, a counteropening can be made at the external lateral portion, which procedure, however, is rarely indicated.

Taptas advanced his ideas twenty-six years ago (in 1900, at the Congrès de médecine intern, Paris, and at the Congrès int à Lisbon, in 1906). He reports a case in point.

A man, aged 64, suffering from chronic nephritis, was operated on under local anesthesia by Taptas. The septum between the two frontal sinuses was destroyed, and polyps and fetid pus were found. The ethmoid region and both sphenoidal cavities were filled with pus and polyps. After removal of the polyps and curettement of the frontal and sphenoidal sinuses, the patient was completely cured. The advantages of the method are:

1. It is technically very easy, because the whole operation consists of the creation of the frontomaxillary opening.

2. It permits a thorough cleaning of the diseased parts.

3. It protects against all intracranial and orbital complications.

4. It does not disfigure the patient even in cases in which a wide sinus required a counter opening at the outer portion of the anterior wall. This wall remains intact toward the middle line, so that a depression need not be feared, which occurs after resection of the anterior wall. The skin incision is sutured. There are no drains introduced, neither outside nor into the nose.

AMBERG, Detroit.

Miscellaneous

ETIOLOGY OF MYRINGITIS BULLOSA. E. V. ULLMANN, Monatschr. f. Ohrenh. **1**:41, 1926.

An interesting study leads the author to identify myringitis bullosa as a distinct disease, an acute inflammation due to a filterable virus. It resembles herpes in that an inflammatory reaction (keratitis) is induced in rabbits by eroding and inoculating the cornea with the serum obtained from a bulla on the tympanic membrane of the patient. The serum from a bullous myringitis occurring as a feature of an acute otitis media, on the other hand, produces no corneal reaction whatever. This coincides with the observations of Doerr (*Zentralbl. f. Dermat.*, 1925) who demonstrated the immunity of the rabbit cornea to streptococci, staphylococci and pneumococci.

When the myringitis-keratitis subsides, it produces an immunity which resists a second corneal inoculation. The same is true of herpes. However, that myringitis bullosa is not identical with herpes was demonstrated in the following manner. Herpes virus was inoculated into corneas that passed through a myringitis-keratitis and that later proved refractive to a second inoculation; a violent keratitis ensued.

The myringitis virus and herpes virus produce certain similar reactions — experimental keratitis and immunity against reinfection — yet are not identical diseases because herpes virus can infect a cornea immune to myringitis virus.

GLOWACKI, Detroit.

CONCERNING THE CLINIC OF OTOGENOUS BRAIN ABSCESS. ROBERT LUND, Ztschr. f. Hals-, Nasen- u. Ohrenh. **14**:341 (April 27) 1926.

Lund's contribution comprises a comprehensive study of thirty-six cases of abscesses of the cerebrum and twenty cases of abscesses of the cerebellum. The subject is treated exhaustively from many angles under the following headings:

1. Material and statistic.
2. Bacteriology of the otogenous brain abscess.
3. Cerebellar nystagmus in otogenous abscess of the cerebellum.
4. The cerebrospinal fluid in otogenous brain abscess.
5. The condition of the pulse in diseases of the labyrinth, and in the otogenous intracranial complications, with special consideration of brain abscesses.

While the article must be read in the original, a few sentences may be picked out at random. Among the fifty-six brain abscesses, fifty were caused by a chronic and six by an acute middle ear suppuration. Abscesses of the cerebrum were more frequent on the right than on the left side.

In twenty-nine cases the bacteriologic finding were as follows: Streptococci were found in five cases, alone three times; pneumococci were found in fourteen cases, alone six times; staphylococci were found in four cases, alone once; colon bacilli were found in twelve cases, alone four times; other microbes were found in three cases, alone once.

The streptococcus as a pathogenic microbe plays a relatively small part in the otogenous brain abscess if compared with otogenous complications. Lund found the same to be the case in otogenous meningitis, whereas the strepto-

coccus is prevalent in the perisinus abscess and sinus phlebitis. The dura forms a barrier through which the aerobic streptococcus can break only with difficulty.

Proteus vulgaris was observed in twenty-three cases. In all, bacteriologic examinations were made in about 800 mastoid operations. Of the twenty-three, fourteen were cases of ordinary mastoiditis. In the others, an intracranial complication was present. The proteus vulgaris must be considered to be an accidental saprophyte.

The prognosis in Lund's patients, in those in whom the colon bacillus was present in a brain abscess, besides the pneumococcus, was very bad. All twelve patients died in whom this occurred. Most abscesses of the brain are polymicrobic.

The spinal fluid was mostly free from microbes. In eight cases microbes were found; in five cases the fluid was polymicrobic. It seems possible that a polymicrobic spinal fluid points to a secondary meningitis and to the presence of an intracranial complication, frequently to a brain abscess. The presence of the colon bacillus in the cerebrospinal fluid points to a secondary meningitis and to a primary sinusphlebitis, or more frequently to an abscess of the brain.

The pressure of the spinal fluid increases and decreases in proportion to the increase and decrease of the polymorphonuclear, and in reverse proportion to the rise and fall of the mononuclear pleocytosis. At any given time of an abscess, any kind of a picture of the spinal fluid may be found.

A typical picture for a single examination cannot be established in otogenous brain abscess.

The views of Knick and Fleischmann can be confirmed, namely, that the otogenous complicated or not complicated brain abscess almost always is accompanied by pleocytosis in the cerebrospinal fluid. The degree of pleocytosis gives, however, a very unreliable picture of the leptomeningeal changes.

The presence of cells in the cerebrospinal fluid, even if the cells are exclusively of the mononuclear type, almost always signifies a participation of the leptomeninges. The picture of the spinal fluid is characterized by its changing quality from puncture to puncture. If the decrease of pleocytosis suddenly ceases and a renewed increase takes place, another intracranial complication besides meningitis is present, for instance, a deep epidural abscess, a subdural abscess or a brain abscess. If there exists a certain pleocytosis in the spinal fluid in consequence of a secondary meningitis, the pleocytosis remains unchanged or is slightly decreasing until sooner or later the abscess again causes an increase of the number of cells. No distinct changes of the spinal fluid occur again except if the abscess ruptures, or after surgical interference. Another spontaneous decrease of pleocytosis is rare. Mygind has called attention to the fact that, although it occurs rarely, a fatal leptomeningitis without further intracranial complications can show a clearing up of the spinal fluid. The same holds good for a subdural abscess. In the latter instance, it is not unusual.

It is evident that a single spinal puncture is of little diagnostic value for the differential diagnosis. The repeated examination of the spinal fluid, however, is often of deciding diagnostic importance, not only in cases in which it is clear with little pleocytosis, and, simultaneously, pronounced intracranial symptoms are present, but also in cases in which pleocytosis is changing as described before.

	Slow Pulse					Normal Pulse						
	Pressure >300	Pressure = <300	Pressure ?	Total	Of These Died	Pressure >300	Pressure = <300	Pressure ?	Total	Of These Died	Total	Percentage of Slow Pulse
No labyrinthian meningitis	9	1	4	14	8	11	18	6	35	8	49	28
Diffuse destructive labyrinthian meningitis	3	0	6	9	7	7	8	1	16	6	25	36
Serous labyrinthian meningitis	1	2	1	4	4	1	2	1	4	0	8	50
Otogenous sepsis	3	1	1	5	4	6	2	4	12	4	17	30
Abscess of the brain	6	5	20	31	29	4	1	11	16	9	47	65
Acute encephalitis	1	0	1	2	2	3	0	0	3	0	5	40
Total	23	9	33	65	54	32	31	23	86	27	151	..
Mortality	..	..	..	..	81%	..	..	..	..	..	32%	..

There is probably no doubt that a vestibular bradycardia is comparatively frequently found in diseases of the labyrinth, in which the function of the labyrinth has not totally disappeared. It is different in the acute destructive labyrinthitis.

Nueshman reported some cases of postmeningeal bradycardia, in which the pressure of the spinal fluid was not increased but in which a decreasing pleocytosis was observed in the cerebrospinal fluid. He is of the opinion that no "pressure pulse" was present, but that the bradycardia must be attributed to a toxic distant effect on the centers of the vagus. Perwitzchky could not produce a "pressure pulse" by raising the pressure in the brain (compression of the veins). Lund made the Queckenstedt experiment and increased the intracranial tension. This is done by exercising pressure on both internal jugular veins in the trigonum caroticum. Lund could increase the pressure easily by 300 mm. The pulse cannot be influenced thereby. In one patient, Lund observed that the pressure rose to 550 to 600 mm. without changing the pulse rate.

Jansen has reported a case in which a large abscess of the temporal lobe had caused a considerable flattening of the gyri cerebri without producing a slow pulse. The main cause of the slow pulse, which is found so frequently in otogenous acute intracranial diseases, must be found in a toxic irritation of the vagus. The bradycardia, resulting therefrom, is a bad sign, which probably is analogous to the ominous bradycardia, described by Traube, and which is at times observed at the height of acute infectious diseases.

MULTIPLE FOREIGN BODIES IN THE RESPIRATORY AND DIGESTIVE TRACT. GEORG RIEDEL, Ztschr. f. Hals-, Nasen- u. Ohrenh. **14**:386 (April 27) 1926.

Multiple foreign bodies are mostly found in small children. Special care must be taken in the examination and extraction of fishbones. These are broken when they enter the trachea or the esophagus, and also when they are extracted. Therefore, meticulous care is indispensable in examining the operative field and during extraction. Riedel cites several cases of his own, and a number of cases reported by various authors.

THE CARCINOSARCOMA, ITS DIAGNOSIS AND NOMENCLATURE, AND AN APPARENTLY HEALED CARCINOMA OF THE UPPER JAW. H. A. WOELK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **14**:392 (April 27) 1926.

There is no uniform conception concerning the origin of carcinosarcoma. A secondary development of sarcoma, or of the carcinosarcoma, is the most plausible point of view. This coincides with animal experimentation. One should only speak of carcinosarcoma and of sarcomalike structure of the carcinoma. The name carcinoma sacromatodes should be avoided, because this name refers to an entirely different tumor. All doubtful cases should be excluded. As an example, an apparently cured cancer of the upper jaw has been described, which, after irradiation appeared like a fibrosarcoma with minute rests of carcinoma, when previously a carcinoma, rich in cells, had existed.

AMBERG, Detroit.

Society Transactions

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, MONTREAL

May 31-June 2, 1926

JOHN M. INGERSOLL, M.D., *President, in the Chair*

PRESIDENT'S ADDRESS.

After extending a cordial welcome to the newly elected members of the Society, President Ingersoll dwelt briefly on the many unsolved problems in otolaryngology, notably those concerning deafness. He called attention to the existence of various research funds and prizes available for investigation and offered by several of the Societies, and suggested that these might all preferably be controlled and administered by a single committee appointed for this purpose. Praise was bestowed on the achievements of the Board of Otolaryngology in its attempt to standardize the qualifications for the specialty and to stimulate the attainment of the highest possible ideals. In closing, the president urged that all members proposing new names should recommend only those men who would truly strive to maintain the high standards set before them.

DEMONSTRATION OF THE LOWER AIR PASSAGES BY INTRATRACHEAL INJECTIONS OF LIPIODOL. Presented by DR. A. C. FURSTENBERG, Ann Arbor, Mich., and DR. P. M. HICKEY, Ann Arbor, Mich. (by invitation).

Some satisfactory and safe method of delineating the bronchial tree has long been needed. The older use of bismuth powder and iodide solutions has of late been largely superseded by the employment of lipiodol, a bland vegetable oil, opaque by roentgen-ray examination, with 40 per cent iodine content, first employed by Forrestier in demarcating spinal cord lesions. Three principal methods of introduction of the oil into the respiratory tract have all been championed: (1) The supraglottic, with introduction by a laryngeal syringe under indirect vision; (2) the subglottic, by means of a curved cannula and trochar introduced through the cricothyroid membrane, and (3) the intrabronchial, with the usual technic employed in any bronchoscopy. The first is suitable only for adults, while the second is not without the danger of false passage and infection. According to these authors, the intrabronchial method facilitates a more accurate examination of the local pathology and a more exact deposition of the lipiodol into that portion of the lung to be examined. Amounts up to 50 cc. have proved to be entirely innocuous, though smaller amounts will often give more satisfactory results, since massing of the injected oil often leads to erroneous conclusions as to the extent of the lung pathologic changes.

Mention is made of the method of introduction by the Iglauer intubation tube, in conjunction with which is pointed out the importance of the patient's position immediately following injection in facilitating a satisfactory roentgen-ray picture. A dorsal prone position may prevent the oil from reaching the anterior portions of the lung, since oil once in the peripheral alveoli and lung parenchyma cannot be dislodged. Portions of oil may be coughed up soon after injection; other portions may remain without apparent harm or symptoms of iodism for as long as two months. The authors advocate this method, particularly in bringing to light disease in portions of the lung obscured by

the heart shadow and in bronchiectatic cases in which the unaided roentgenogram fails to reveal dilatations and cavities. Even with the use of the oil, abscess cavities blocked off by swollen bronchial mucosa or which fail to communicate with a bronchus, will not be shown. Such bronchial occlusions must be differentiated from those due to cicatricial stenosis and to malignancy, conditions in which lipiodol injections afford interesting and valuable data, as is also frequently the case in nonopaque, bronchial foreign bodies.

Finally the oil itself has been thought to be of some therapeutic value, and to be of preoperative and postoperative aid to the thoracic surgeon.

DISCUSSION

Dr. J. A. Stucky, Lexington, Ky., felt that although in careful and experienced hands, lipiodol injections have a distinct diagnostic value, caution was needed in any procedure depositing in the delicate air chambers of the lung a heavy liquid which must eventually be gotten rid of, and of which the clinical value is far from established.

Dr. David Ballon, Montreal, supported the bronchoscopic method of introduction as his favorite, and recounted his results in a wide variety of pulmonary conditions including normal lungs, gas cases, asthma, bronchiectasis, tuberculosis, abscess and thoracoplasty. He called attention to the ease with which bronchiectatic cavities empty themselves in contrast to abscesses, in which the failure of the oil to enter a pulmonary area is often of great diagnostic value. Caution should be observed in the injection of all patients with late tuberculosis.

Dr. Frank R. Spencer, Boulder, Colo., considered lipiodol of therapeutic value in cases of bronchiectasis, but of little use and even of harm in pulmonary tuberculosis.

Dr. Samuel Iglauer, Cincinnati, Ohio, gave a demonstration with lantern slides of his intubation tube for lipiodol injection, claiming for this method less strain on the patient and ease of change of position, particularly in conjunction with the fluoroscope by which the course of the oil can be followed and modified. He also showed its value in throwing light on laryngeal or tracheal stenosis in which the vertical extent of the lesion can be visualized either by the fluid or by the use of a rubber dilatable balloon filled with it.

Thrombosis of the Lateral and Cavernous Sinuses Complicating Acute Mastoiditis. Presented by Dr. Elbyrne G. Gill, Roanoke, Va.

The unreliability and variety of the classical signs of sinus thrombosis often render a diagnosis of this serious condition difficult. Only by a complete consideration of the temperature, the general appearance of the patient, the white and differential blood counts, and the bacteriologic findings and blood culture can a reliable diagnosis of thrombosis be made. Once this is established, the proper treatment consists in jugular ligation followed by investigation of the lateral sinus over a wide area with incision and evacuation by suction of the clots contained within until free bleeding from each end is secured.

The author cites two cases of sinus thrombosis following acute mastoiditis, the first complicated by bilateral tuberculosis of the hip but ending in recovery, the second complicated by typhoid fever and eventuating in cavernous sinus thrombosis and death. In the latter, in spite of wide removal of the clot, it was impossible to obtain free bleeding of either end. Mercurochrome-220 soluble proved of no avail.

In conclusion, the author points out that in each case there was a general systemic disease tending to lower the patient's resistance to septicemia, and

rendering all the more difficult an accurate estimate of the part played by the thrombosis. He urges the value of a daily polymorphonuclear and leukocyte count, and a careful bacteriologic study in every acute mastoid infection.

DISCUSSION

Dr. Curtis C. Eves, Philadelphia, recounted the essential symptoms leading to the suspicion of sinus thrombosis and stressed as the cardinal points to be striven for: (1) Eradication of the initial infection, and (2) prevention of extension of the septic process into the blood stream by jugular ligation and, if necessary, resection of the vein. During after-treatment, particular attention should be given to signs of extension of infection toward or beyond the torcular end of the sinus.

Dr. Robert Sonnenschein, Chicago, cited a case of sinus thrombosis with fatal extension to the opposite side.

Dr. Ewing Day, Pittsburgh, favored the use of suction in the removal of clots from both bulbar and torcular ends of the sinus. If the clots cannot be removed in this manner, organization and fibrosis has taken place, and this natural defense of nature had best be left undisturbed.

Dr. Richmond McKinney, Memphis, urged, in the treatment of septic thrombosis, the great value of transfusions of whole blood, either before or after jugular ligation.

Dr. Wendell Phillips, New York, cautioned against the making of a hasty diagnosis of cavernous sinus thrombosis, a suspected condition which on necropsy has been often found to be basilar meningitis. He also favored transfusion.

Dr. Samel Kopetsky, New York, preferred transfusion from an immunized donor, with ordinary whole blood given if necessary during the interim of preparation.

Biopsy in Suspicious Growths of the Larynx. Presented by Dr. Charles J. Imperatori, New York.

The fallacies to which even expert indirect laryngeal examination is subject make such a method of diagnosis of laryngeal malignancy unreliable. Biopsy is the only positive method of establishing the early presence of cancer, but has been opposed by some men on the ground of exciting lymphatic metastases. However, experiment has shown that a clean cut removal of a portion of tissue from the cords, to which the lymphatic supply is very meager, does not induce extension such as follows palpation or rough handling. With a negative microscopic report the exclusion of cancer is not positively assured, and much weight must be given to the rest of the clinical picture. Tuberculosis and syphilis should be most carefully excluded, and the exceptions to the Wassermann reaction should be constantly borne in mind. The author urges that biopsy invariably be preceded by the patient's clear understanding of, and consent to, immediate radical operation, if indicated, within forty-eight hours. Removal of the specimen is best accomplished with a sharp punch or knife, both a central and peripheral section, if possible, being included without subsequent cauterization.

DISCUSSION

Dr. John E. MacKenty, New York, considered cordal biopsy relatively innocuous as contrasted with that of laryngeal tissues higher up. This check on diagnosis will always be more essential to a man of limited experience than to

one who is constantly dealing with laryngeal disease. A careful history is of the utmost importance in order to avoid the misleading conclusions that might be hastily drawn from a positive or negative Wassermann reaction, or roentgen-ray examination of the chest. Since even biopsy has been followed by needless operation, all microscopic diagnoses should be checked by at least two expert pathologists to avoid error in so important a matter. Immediate radical operation renders biopsy far less dangerous, preparations for which should always be made beforehand.

Dr. Norval Pierce, Chicago, cautioned against needless biopsy, in cases in which major surgery is sure to be refused.

Dr. Joseph C. Beck, Chicago, said that he had never seen a case of laryngeal cancer spread as a result of biopsy, in contrast to serious errors and unnecessary operations because of failure to make use of this diagnostic measure. He urged the need of regarding biopsy as a surgical operation and of hospitalizing the patient following this procedure.

Dr. Richmond McKinney, Memphis, reported a case of tuberculoma of the larynx, in which a positive but erroneous biopsy report had led to a total laryngectomy.

Dr. Imperatori (closing) felt that biopsy should be considered simply as an important adjunct in the diagnosis of laryngeal cancer, and as only a part of the general clinical picture in determining the need of operation.

How the Deafened Are Helping the Otologist. Presented by Dr. Gordon Berry, Worcester, Mass.

The author presents a comprehensive and picturesque account of the efforts and accomplishments of the twenty-four local branches of the American Federation of Organizations of the Hard of Hearing. In each branch, deafened workers are effectively helping in lip-reading education, vocational training, provision of amusements and employment aid, often thus affecting a complete change in a patient's life and returning him to work as a useful and happy member of society. The maintenance of a special bulletin for the deaf, the use of amplified telephones, and the provision of suitable audiophones are features of the type of service being rendered by local groups of workers.

Figures presented to show the work of routine testing of hearing in the public schools indicate the enormous need for continued activity in this new and revolutionary field of public health. As a result of these studies, better hearing facilities are being provided for deafened children who were previously unaided and greatly handicapped, lip-reading classes have been organized, and children have been taught separately when necessary. Pressure to accomplish this has been brought to bear on the school authorities by showing the great financial loss involved in the necessary repetition of school work required by deaf children who fail of promotion. This loss is three times that incurred by simply backward pupils.

In all this work only a beginning has been made, and there is need of its extension throughout the country where it is still unrecognized, but effective progress can come only through enthusiastic and active cooperation on the part of all otologists.

DISCUSSION

Dr. Norval Pierce, Chicago, favored the adoption by the Society, of a resolution supporting the movement for public school hearing examinations and of special classes for children showing even a beginning loss in hearing.

Dr. Charles Richardson, Washington, praised the national organization for its splendid work, and urged all otologists to give it their enthusiastic local support. He recounted the method of instituting hearing examinations in the Washington schools by bringing the problem and the need of its solution before the highest authorities rather than those of lesser influence.

Dr. Berry (closing) pled for the organization of local branches in all places in which they do not at present exist, since only in this way can effective progress in this work be made.

Membranous Tracheobronchitis and Laryngitis (Nondiphtheritic). Presented by Dr. T. R. Gittings, Sioux City, Iowa.

Membranous laryngotracheobronchitis is an acute upper respiratory infection occurring usually in children, and accompanied by symptoms of both toxemia and respiratory obstruction. It is often mistaken for diphtheria owing to the discovery, on culture, of a few Klebs-Loeffler bacilli, which are present as a contaminant and not as the true causative organism, which is usually either the streptococcus or the staphylococcus. Quite frequently, no laryngeal membrane can be seen owing to its obscuration by supraglottic edema, while in many instances no true membrane is present. The author reports his experiences with fourteen patients with this condition, ten of whom required tracheotomy for marked laryngeal obstruction, intubation in two others being found to be very unsatisfactory. In no case was there present a tonsillar or faucial membrane, in contrast to true diphtheritic laryngitis. A typical case is described in which, after the marked but transient relief to dyspnea afforded by tracheotomy, signs of respiratory obstruction again appear, due to the filling up of the lower air passages with a thick, tenacious, mucopurulent secretion. Rapid inspiration through the tracheal tube of air unwarmed or moistened by the nose leads to the formation of crusts and lumps of inspissated secretion, which must be removed constantly either by deep suction or even by bronchoscopy. Various expectorants such as ferrous iodide may be employed to liquefy these secretions in conjunction with benzoin inhalations, while the instillation of a few drops of epinephrine chloride into the trachea is regarded by the author as having a distinctly beneficial result. The additional factor of sepsis complicating this bronchial obstruction tends to result in a surprisingly high mortality, as evidenced by the author's figures showing six deaths in the ten cases requiring tracheotomy. Four patients with milder symptoms recovered without any operation. An initial dose of diphtheria antitoxin is advisable in every instance, since in the absence of diphtheria no harm will result, and in the event of its presence much valuable time will have been saved.

The paper closes with a summary of the experiences of a few other men with this most serious condition, for which at present the available methods of treatment are far from adequate.

DISCUSSION

Dr. Robert C. Lynch, New Orleans, stated that he had found the staphylococcus to be the infecting organism in those patients presenting lesions high up in the tracheobronchial tree, the streptococcus in those lower down. He urged the routine use of diphtheria antitoxin in these cases. He strongly condemned intubation as leading to laryngeal stenosis and ulceration, and to far greater difficulty in decannulation than occurs after tracheotomy for diphtheritic laryngeal obstruction.

DR. GITTINS (closing) reported no difficulty in decannulation of patients who had had tracheotomy.

THE RELATION OF TACTILE SENSE IMPRESSION AND HEARING PERCEPTION. Presented by DR. MAX A. GOLDSTEIN, St. Louis.

Basing his arguments on the premise that all sense organs may be regarded as modifications of the sense of touch, the author traces the evolution of an elementary tactile organ through the stages exemplified by the lower animals. He points out the primarily epithelial character of all such structures as lateral line organs, taste buds, pacinian corpuscles, the eye, and the ear, and the analogy in their microscopic structure, as seen in a comparison with the cellular arrangement of the olfactory organ, the retina, and the organ of Corti.

That tactile and auditory sensations merge and complement one another is shown in any audiometric test by the point at which auditory perception ceases and sense perception begins. That the sense of touch can be educated to supply a lack in some other sense is well exemplified in the Braille reading by the blind. In the same way, the totally deaf may develop a highly sensitive and educated sense of touch, which may be trained to be of the utmost value to these unfortunate patients.

The author next gave a most interesting practical demonstration of tactile perception in a deaf patient by the use of a megaphone, the large end of which was covered with a paper diaphragm. Placing her fingers against this, a totally deaf girl of about 12 was able to duplicate words spoken through the megaphone, and perceived by her solely through the medium of her sense of touch.

DISCUSSION

PROF. ROBERT H. GAULT cited the fact that anesthetization of certain sensitive areas of the face will have a definite effect on the acuity of a normal person's hearing. He stressed the importance of this approach to the deaf patient through his sense of touch, since, although it fails to enable him to hear conversation, it may be of some aid in giving him an idea of the general "drift" of speech.

DR. E. P. FOWLER, New York, mentioned good bone conductivity often possessed by these apparently totally deaf patients, in whom this perceptive faculty must be largely tactile rather than auditory.

DR. CHARLES M. ROBERTSON, Chicago, told of a young deaf and blind girl, whose other senses have been so developed that she can differentiate colors by smell and both hear and talk by means of tactile perception.

DR. GOLDSTEIN (closing) stressed the fact that in all such patients, education must come through the substitution of one tactile impression for another.

THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS OF THE LARYNX. Presented by DR. EDWARD A. LOOPER, Baltimore.

Urging that tuberculosis of the larynx be no longer regarded as a hopeless condition, unamenable to treatment, the author stresses the unsuspected frequency of this complication of pulmonary tuberculosis and the need of more careful examination of patients for the possible existence of this local lesion. On its early recognition depends much of the success of all antitubercular therapy, since patients with laryngeal involvement cannot satisfactorily eat, sleep or rest. Only by a frequent routine laryngeal examination can the early cases be discovered, since laryngeal lesions appear long before they give rise

to symptoms, particularly those of the posterior wall in which pain is a late factor and in which infected sputum is prone to collect. The disease progresses through stages from hyperemia and hyperplasia to tubercle formation, ulceration, and infection, with involvement first of the vocal processes, then the cords, and lastly the epiglottis. Every effort should be made to make a diagnosis from objective rather than from subjective symptoms, since, according to the location of the lesion the latter may not arise till late in the course of the disease.

Discussing the treatment, the author lays the greatest emphasis on absolute vocal rest, so complete that the patient carries on all conversation by writing. As the best local treatment, he advocates the electric cautery, either indirectly with the laryngeal mirror, or directly through the laryngoscope. As supplementing these he urges strict antituberculosis hygiene, if possible in a sanatorium, with adherence to the same dietary and rest measures as would be imposed on any pulmonary patient.

DISCUSSION

Dr. Frank Spencer, Boulder, Colo., emphasized the great importance of early diagnosis and the value of complete rest. He felt that indirect cauterization was less of a strain on the patient than direct, and that, in carrying out either method, consideration should be given to the internist's opinion as to the patient's condition. The painstaking treatment of early cases will yield a large number of cured patients.

Dr. Thomas Carmody, Denver, considered that over 90 per cent of any large group of pulmonary patients will be found to show some laryngeal involvement, even if no more than a simple hyperemia, and they should all be treated by rest of both voice and body. He commented on the absence of a true tuberculosis of the laryngeal cartilages, and of the nonexistence of a true primary laryngeal tuberculosis.

Other therapeutic agents of marked value are sunlight and the operative procedure of pneumothorax.

Dr. Julius P. Dworetsky, Liberty, N. Y., felt pneumothorax to be of great value in preventing laryngeal complications in a large number of tubercular cases, and in improving the laryngeal condition if already present.

Dr. Thomas Harris, New York, urged a laryngeal examination in all sanatoriums by someone competent in this procedure. Treatment begun at the stage of simple hyperemia will give the best results.

Some Observations on Furunculosis of the Auditory Canal. Presented by Dr. Dunbar Roy, Atlanta, Ga.

An unusual epidemic of aural canal infections following city pool bathing has led the author to an investigation of this rather common condition. He divides it into two types: (1) The diffuse, and (2) the circumscribed, or so-called furuncle of the canal. As etiologic factors in the development of canal infections, he enumerates chronic middle ear discharge, foreign body, cerumen, trauma from the introduction of a variety of objects, and eczema. Pathologically, a general hyperemia results, followed by destruction of epithelium, glands and hair follicles. Swelling and congestion are followed by pain and tenderness, gradual resolution taking place without pus formation or local fluctuation except in the case of the furuncle.

In the circumscribed infection, much of the symptomatology depends on the location in the canal, the more external the lesion, the less being the pain and

tenderness, since here there is less adherence to bone and periosteum and less resistance to pus accumulation.

An accurate diagnosis is sometimes difficult, owing to a concomitant otitis media. In addition, a canal infection may itself give rise to postaural signs closely simulating those of mastoid infection, in which instance it becomes most important to determine the absence or presence of a middle ear involvement. The author cites two cases in which these problems arose, one of which proved to be a simple furuncle, the other a mastoid infection requiring operation. That even simple canal infections may lead to serious consequences is shown by a fatal case of bilateral sinus thrombosis which originated from a furuncle of the external meatus.

The author restricts surgical incision to those cases with evident pus formation and fluctuation in the external portion of the canal. For deeper lesions he uses packing with a full strength phenol and camphor preparation. Additional aids are 5 per cent aluminum acetate in the canal, hot fomentations, stock staphylo-streptococcus vaccines, and narcotics.

DISCUSSION

Dr. H. Marshall Taylor, Jacksonville, Fla., reported having seen these infections in public bathers without obtaining the causative staphylococcus from the pool water. The water plays its part largely by producing a desquamation of the canal epithelium, just as it does on that of the hand, and thus rendering it more susceptible to the organisms always present in the canal. Man is not naturally an aquatic animal, and has not, as do many aquatic animals, any protective mechanism for excluding water from the inner portions of his ear. The rubber cap worn by women bathers explains the greater frequency of this infection in men.

Dr. Arthur I. Weil, New Orleans, offered as an explanation of the fact that furunculosis is more common in the South than elsewhere, the tendency for bathers in a warm climate to remain longer in the water and thus to occasion a greater degree of epidermal maceration in the canal. He advised protection by packing the canal with nonabsorbent wool and the use of a rubber bathing cap.

Dr. S. MacCuen Smith, Philadelphia, outlined his treatment of deep incision, under gas anesthesia, curetting of the canal wall, application of tincture of iodine, and packing of the cavity with iodoform gauze wicking.

Dr. Charles W. Richardson, Washington, D. C., felt bathing to be only a secondary factor which tended to reduce the patient's general bodily resistance.

Dr. Irving Voorhees, New York, recalled an unpleasant experience in which, after incision of one furuncle another appeared opposite it, and he felt that local treatment with such medicaments as phenol (carbolic acid) and locally applied mercurochrome-220 soluble produced better results than surgery.

The Intravenous Use of Mercurochrome-220 Soluble in Septicemias. Presented by Dr. Charles T. Porter, Boston.

The author presented a summary of his work in the use of mercurochrome-220 soluble in fifty cases of septicemia following mastoiditis. He demonstrated with lantern slides the effect on septic types of temperature of the repeated intravenous injection of the drug, offering as an explanation of an extremely low mortality the fact that the drug was given in small doses, at frequent intervals and on a falling temperature. It is his custom to give less than 5 mg. per kilogram of body weight if there is a positive blood culture, since

the reaction and load on the kidney come not from the drug itself, but from the number of bacteria which are killed by it. Hence the sicker the patient the smaller should be the dose. A valuable adjunct in the presence of any degree of anemia (below 2,000,000 red cells) is transfusion, sometimes with the drug placed in the transfused blood.

DISCUSSION

Dr. Wells P. Eagleton, Newark, N. J., confessed having been prejudiced against the use of mercurochrome because of a case of hemiplegia resulting from its employment. He felt that this might, however, have been due to improper administration or to overdose.

The Results of a Survey of School Children by Audiometric Methods. Presented by Dr. Horace Newhart, Minneapolis.

Reporting the results of 1,000 hearing tests on Minneapolis school children, the author describes his initial difficulties in attempting to use old style testing methods, which proved to be both inaccurate and time consuming. At present, with the Western Electric multiple phone apparatus, it is possible to test from 100 to 120 children per hour. This saving in time has made it possible not only to record the hearing losses discovered, but to keep notes as to previous aural diseases, nose and throat complications, and infectious diseases. Future plans include a yearly check-up on the deafened children, and the reference of children needing any treatment to dispensaries or to private doctors.

DISCUSSION

Dr. Harris P. Mosher, Boston, stressed the importance of discovering the deafness early, and of all otologists becoming interested in this somewhat unromantic but all-important subject.

Dr. Harold Hays, New York, cited the fact that in New York schools, over 5 per cent of the children showed defective hearing. He discussed the difficulty of properly treating these young patients in a busy dispensary, and felt that some special provision must be made for them.

Dr. Charles Richardson, Washington, D. C., recounted great movements of progress in the past, which had all been characterized by some degree of initial failure. The public is only just beginning to recognize the importance of this work and the physicians to realize their past neglect.

Dr. Newhart (closing) urged that children be tested at the beginning of the year when they were mentally rested, and also on returning to school from any illness, to detect at this time any diminution in hearing.

Functional Hearing Tests. Presented by Dr. George W. MacKenzie, Philadelphia.

In defense of some of the older methods of testing by forks, the author claims for them a greater value and accuracy than can at present be obtained with the audiometer, particularly as concerns qualitative diagnosis in the location of a given lesion. Analyzing deafness as a symptom common to most ear diseases, he shows that its amount is proportional to the intensity of the pathologic process; its character to the location of the lesion. By character, he differentiates deafness as: (*a*) associated with poor bone conduction; (*b*) associated with good or better than normal bone conduction; (*c*) for low tones with relatively normal high tones; (*d*) relatively for low, middle and

high tones, and (*e*) total, for all tones. The increased bone conduction in obstructive deafness is explained on Alexander's theory of the four courses followed by sound waves striking the mastoid process: (1) through the bone to the middle ear and out the canal; (2) through the bone to the middle ear and out of the eustachian tube; (3) through the bone, middle ear and ossicles to the inner ear; (4) through the bone directly to the inner ear. In obstructive lesions, one or more of these escapes is closed off, intensifying the sound.

A thoroughly accurate diagnosis of deafness necessitates the determination: (1) of the site of the lesion (qualitative); (2) of the character of the lesion (pathologic); (3) of the intensity or degree of involvement (quantitative); and (4) of the primary cause (etiologic). Of these, the first is the most important. The author next shows by charts how a careful comparison of bone and air conduction by the use of properly standardized forks will lead to a greater degree of accuracy in diagnosis than is possible with the audiometer, since with the latter some bone conduction complicates air conduction through the use of the ear phones.

Summing up the two methods, the author finds the forks of far greater service in accurate location of a lesion, and the audiometer of greater quantitative value in the making of a graphic and standard record of a patient's hearing.

DISCUSSION

Dr. C. C. Bunch, Iowa City, recounted his work with both forks and the audiometer, undertaken always with the four objectives of teaching, the patient's treatment, good records and increased knowledge. He advocated the use of both methods, the forks for qualitative tests such as the Rinne, and the audiometer for quantitative tests. He felt that bone conduction as complicating audiometric tests by air was negligible.

Dr. Harold Hays, New York, condemned the use of forks, owing to the unavoidable psychologic error on the part of both the patient and otologist and was in favor of the more accurate and impersonal audiometric methods.

Dr. Robert Sonnenschein, Chicago, urged against the audiometer its high initial cost, and its inability to test bone conduction. Forks properly standardized can be used with almost the quantitative accuracy of the audiometer.

Dr. MacKenzie (closing) called attention to the published audiograms of a given aural condition; none of them show the same type of curve.

Reactions Induced Through the Ductus Endolymphaticus and the Aqueductus Cochleae. Presented by Dr. Lester M. Hubby, New York.

Seeking for an explanation of the study outflow of muscle tonus impulses proceeding from the labyrinth, the author advances his theory that they arise from stimuli originating in the spinal fluid and reaching the labyrinth via the aqueductus cochlea directly and the ductus endolymphaticus indirectly. In the case of the latter, spinal fluid pressure changes, constantly taking place, are communicated to the ductus through the saccus endolymphaticus which lies in the posterior fossa between the dural folds. By this mechanism, waves of stimuli reach the endolymphatic system and are absorbed by the elasticity of the oval window, while those reaching the perilymphatic system via the aqueductus cochleae are absorbed by the round window, the two systems thus

balancing each other. In reverse manner, the saccus acts as a safety valve for increased intralabyrinthine pressure.

The author next explains vertigo as the result of an upset in balance between the nerve impulses from each labyrinth, due either to hypersensitivity of one vestibular nerve, a unilateral change in intracranial pressure on the saccus, or to a variety of intravestibular abnormalities.

A word is added as to explanation of some remnant of hearing even in patients with the round and oval windows totally occluded by solid bony growth, the author believing that sound waves still reach the organ of Corti via the aqueductus cochleae and the ductus endolymphaticus.

DISCUSSION

Professor Magnus, Utrecht, Holland, felt that there should not be a too hasty acceptance of even an ingenious theory of this sort. He cited MacNally's work on the saccus in rabbits, in which various experiments produced no effect on the labyrinth. While puncture of the round window has an immediate effect on unilateral muscle tone, puncture of the saccus has no such result.

Dr. George E. Shambaugh, Chicago, raised as an objection to the theory of tonal impulses arising from the end-organs in the vestibule the fact that one must account for a constant stream of tonal impulses, and that the mechanism of the macula with its otolith membrane seems best suited to give temporary stimulation only, due to a change in position. When the head is held constantly in one position, the tonus impulses from the end-organs should diminish due to fatigue. It seems much more likely that the flow of tonus impulses from the labyrinth is dependent on the endolymph movements in the semicircular canals, and in order to account for the constant stream of these impulses, it is necessary to produce intermittent impulses. The constant stream of endolymph is visualized by Ewald when he accounted for labyrinthine tonus, a stream being created by the secretion of endolymph in the stria vascularis and its escape through the aqueductus vestibuli has two palpable objections. One is that such a flow of endolymph would not pass through the ampulla, and the second is that there is no escape of endolymph through the aqueductus vestibuli. The ductus endolymphaticus which passes through this bony channel leads only to the saccus endolymphaticus, a closed bag. Dr. Shambaugh, in accounting for the origin of labyrinth tonus, emphasized the manner of producing this stimulation by the intralabyrinthine pulsations which are produced with the beat of the heart. Constant rise and fall of intralabyrinthine pressure cannot avoid producing to-and-fro motion of endolymph as this fluid is forced through the ductus endolymphaticus and displacement of the membrane over the round and oval windows.

Dr. J. Gordon Wilson, Chicago, considered the saccus as simply the point of exit of the endolymph into the venous circulation, blockage of which gives rise to vertigo.

Ludwig's Angina and Mediastinal Abscess Following Tonsillectomy. Presented by Dr. Carl Sautter, New York.

Adducing a survey of the literature for the past thirty years as proof of the rarity of mediastinal abscess as a complication of tonsillectomy, the author comments on the highly radical method of procedure advocated by Glogau in which an incision in the neck is carried to the sternum, and the mediastinum

sealed off above the clavicle by gauze packing, resulting in a considerable cosmetic deformity and incurring the risk of infecting instead of protecting the mediastinum.

A case is reported in which, following local tonsillectomy, Ludwig's angina developed on the sixth day. This was freely incised, with the evacuation of pus and gas. The infection continued to extend downward, and a roentgenogram showed it to be invading the upper mediastinum. Further incision along the anterior border of the sternomastoid muscle was carried down to the sternum beneath which pus could be evacuated. Slow recovery, complicated by osteomyelitis of the sternum requiring sternotrepanation, followed.

In concluding, the author urges the most rigid asepsis in performing local tonsillectomy, frequent use of the roentgen-ray in watching for possible mediastinal extension, and radical incisions in the treatment of Ludwig's angina.

DISCUSSION

Dr. John E. MacKenty, New York, cautioned against injection through the tonsil and local tonsillectomy. In the event of subsequent infection, the patient should be dressed and taken care of throughout by one man. One must differentiate between a true Ludwig's angina and simple phlegmonous swelling of the neck, the former being far more serious and requiring the most extensive surgical incisions in the neck.

Dr. William Mullin, Cleveland, mentioned edema of the larynx as a sign indicative of possible upper mediastinal infection.

Symposium on Focal Infection. Internist's Point of View. Presented by Dr. Judson Deland, Philadelphia.

After a brief historical account of the theory of focal infection, the author lists the wide variety of diseases, covering every bodily system, which may result secondarily from a focus of infection. Restricting himself to adult tonsil or sinus foci, he first shows these structures to be fertile soil for anaerobic bacteria and capable of becoming infected either from the teeth, from other sinuses, or from the blood. Organisms innocuous in one situation become highly virulent when growing in another, especially when aided by intercurrent illness or a generally lowered resistance. Absence of symptoms is no indication of absence of toxemia, and the smallest focus may be a most serious menace, protection against which can only be secured by complete eradication.

In the absence of symptoms, patients harboring a focus till late in life have been untreated in spite of a history of frequent tonsillitis in their earlier years. Aiding in the suspicion of a symptomless focus is an examination of the blood, which often shows a low leukocyte count with an increased percentage of lymphocytes, with or without a mild secondary anaemia. The diagnosis of tonsillar infection must be made largely on the history of previous throat trouble, the condition of the essential glands, appearance of the pillars and the culture of material obtained from the bottom of the tonsillar crypts. Deeply buried tonsils are generally to be viewed with more suspicion than simply hypertrophied ones.

The rôle played by the sinuses as a focus of infection is a less important one than that of the tonsil, and the symptoms are less severe. A sinus may be suspected when there is a history of an acute infectious disease in childhood, from the before-mentioned blood changes, and with a coexisting tonsillar involvement. In a sinus already draining satisfactorily, difficulty is experienced from the fact that absence of pus does not exclude the presence of a focus,

culture often indicating a virulent organism. The roentgen ray is not an infallible means of diagnosis, which must sometimes be made, after at least two examinations, by exclusion.

Complete surgical removal or drainage of the focus is the most effective means of treatment. If vaccines are used, they should be made immediately from the suspected material with the fewest possible transplants. They are a useful adjunct to surgery, and of benefit to patients unsuitable for operation, but care should be exercised in the dosage and administration.

FROM THE NOSE, THROAT AND EAR STANDPOINT. Presented by DR. PERRY G. GOLDSMITH, Toronto, Canada.

The author sees as the chief duty of the otolaryngologist in dealing with focal infections, the determination of whether such foci do or do not exist in the ear, nose or throat. The question as to whether the general symptoms warrant or require that this focus be dealt with surgically is a matter for decision by the internist, unless all symptoms are referred to the local region. Establishment of the existence of a focus is a matter of the most time-consuming and painstaking examination, and a careful history, elicited in the manner of a cross examination, is the first essential. Next should follow careful palpation of the neck, of regional glands, of the tonsil and of the nasopharynx. Important signs pointing to a truly septic tonsil are glandular enlargement, fixation and tenderness, and a cultural growth of streptococcus. Removal of such a tonsil may be definitely indicated, a patient may request its removal, or it may be removed if no other focus can be found. The general condition may be temporarily aggravated by the operation which may better be postponed to a time of quiescence.

In any acute sinus infection, the first inflammatory sign is the production of a protective, antibactericidal, serous exudate, which should not be disturbed by washing or spraying. At this stage the author prefers the term sinus infection, reserving for the term sinusitis the later stage in which true pus is found.

Next is outlined the routine examination of the nose, which consists in general inspection for character and source of abnormal secretions, transillumination, shrinkage with astringents, reexamination, postnasal rhinoscopy, use of the nasopharyngoscope, cleansing and suction, reexamination with mirror and nasopharyngoscope, taking of cultures if indicated, and washing the antrum if any pathologic change is suggested by transillumination. Roentgen ray is only of confirmative value, and must fit the rest of the picture.

Ethmoid suppuration may coexist with infection in the frontal or antrum. If antral washings are clear and pus is seen in the middle meatus, then it must be coming from the ethmoid or frontal. If washings from the latter can be shown to be clear, then the ethmoid is the site of the disease. A large infected cell in a middle turbinate may contain pus as well as the posterior ethmoids, which drain usually into the nasopharynx. Diagnostic puncture of the ethmoid is unwarranted except in a case in which the eyesight is at stake. A simple transitory edema of the ethmoidal mucosa often appears and then disappears without pus formation, which is probably vasomotor in origin and never the mark of a true focus of infection.

Sphenoidal disease is best diagnosed by exploratory puncture and irrigation carried out, not through the ostium, but through the anterior wall. Secretions from this sinus as well as the posterior ethmoids may run down either into the esophagus or the larynx and thereby set up systemic symptoms.

In conclusion, the author sums up the present status of the relationship between posterior sinus disease and optic neuritis, with the opinion that, though patients with such conditions have often recovered spontaneously, nevertheless ventilation of the obstructed side of the nose is followed by such good results that one cannot withhold this procedure in the face of rapidly failing vision.

FROM THE OPHTHALMOLOGICAL STANDPOINT. Presented by DR. W. GORDON BYERS, Montreal, Canada (by invitation).

Presenting a table of constitutional diseases which have been complicated by iridocyclitis, the author points out that, exclusive of tuberculosis and syphilis, a large number have resulted from focal infection in the teeth, sinuses and tonsils. Even cases classified in former years as of cardiac or renal origin, would today probably be regarded as true focal infections, and, in the cases undiagnosed as to etiology, an intestinal focus is probably at the bottom of the matter. An undemonstrated focus may not appear until aggravated by some illness or operation. Relapses in the eye condition may indicate a decrease or increase in the activity of the focus, while other factors such as a uric acid diathesis or fatigue may play a part of unsuspected importance in the activity of the infection.

FROM THE DENTAL STANDPOINT. Presented by DR. EARLE C. RICE, Philadelphia (by invitation).

In recent years, an increased cooperation between the professions of medicine and dentistry has led to a greater interest on the part of the latter in a patient's general condition. Oral and dental sepsis are now regarded as most important factors in the etiology of disease, and as potential foci of infection.

The development of the dental pulp and its surrounding dentine results in a highly organized and vascular structure, capable of becoming infected by either gross or microscopic dental caries. Initial hyperemia and vascular dilatation lead to pain, followed sometimes by strangulation and gangrene, since no lymphatics provide an outlet for the effusion. Such infection may occur in noncarious teeth and without special symptoms, so that necrotic dental pulp may exist entirely unsuspected. Pathologic examination of large numbers of pulpless teeth wholly symptom-free has shown them to be definitely infected and a menace to general bodily health. Conservatism in the face of a patient's good health, absence of any symptoms, and a negative roentgenogram would counsel against removal of a tooth, but later myocarditis, cholecystitis, or corneal ulcer will prove the folly of this point of view. A pulpless tooth cannot be proved positively to be sterile or infected before removal, but prophylactic measures in regard to a thoroughly suspicious tooth will be found to be the best and most efficient form of therapy.

DISCUSSION

DR. FRANCIS P. EMERSON, Boston, felt that laryngologists are responsible for the discovery of a focus of infection, in which problem a careful consideration of the history is of greater import than inspection of the throat. On the other hand, positive pathologic findings may have no bearing on the patient's general condition. A decision on this question is facilitated by the discovery of an adjacent, enlarged and tender tonsillar gland soon after the occurrence of

any throat infection. A corroborative blood picture and differential count will be of additional aid in making a positive diagnosis.

Dr. Ross H. Skillern, Philadelphia, considered that, with the exception of the ethmoid, the accessory sinuses only rarely constitute a focus of infection, and the more chronic the infection and the more evident the purulent discharge, the less likelihood of their being a source of general toxemia. The presence of a blood-stained, watery secretion is much more indicative of serious infection and of the need of surgical intervention.

Dr. Leon White, Boston, stressed the value of the roentgen ray in diagnosis of sinus infection. Transillumination is sometimes inaccurate in detecting the presence of thickened mucous membrane, a condition more indicative of focal infection than the presence of pus. All roentgenograms of teeth should be passed on by an orthodontist, not a roentgenologist, and the teeth should be suspected as a focus before the tonsils or sinuses.

Dr. George L. Richards, Fall River, Mass., felt that there should be more careful attention given to general hygienie and diet, in the hope that this may lead to a diminution of surgical treatment.

Dr. Lewis Coffin, New York, urged that all the simpler means of treatment, such as attention to the intestinal tract be tried before suspecting the teeth, tonsils and sinuses.

Dr. George MacKenzie, Philadelphia, cited a form of neurolabyrinthitis of focal infectious origin, which recently occurred in a semi-epidemic form and was first described years ago by Alexander.

Dr. Edwin McGinnis, Chicago, mentioned differences in virulence between the staphylococcus found in the nose and that recovered from infected bone or a carbuncle. Removal of a local focus does not always benefit a systemic condition like nephritis.

Dr. William Mithoefer, Cincinnati, detailed his method of examination of tonsillar detritus by subjecting the expressed concretions to microscopic examination, and finding that the soft ones contain many lymphocytes while the hard ones contain but few and are hence less indicative of infection. He considers palpation of the glands on the floor of the mouth an important procedure.

Dr. Burt Shurly, Detroit, warned against the lighting up of an early pulmonary tuberculosis by too hasty removal of a supposed focus under ether anesthesia.

Dr. Lee Hurd, New York, feeling that foci frequently occur without symptoms, urged that the development of these should be a signal for a thorough examination of the patient from every possible angle. He also drew attention to the inadequacy of tonsillectomy if remnants of lymphoid tissue in the pharynx could continue to act as a focus.

Dr. John J. Shea, Memphis, described his method of antral irrigation and culture, and the unsuspected findings on allowing the washings to stand. He urged that all patients with focal infections be placed on a sugar free diet.

Dr. James G. Dwyer, New York, advised an analysis of the intestinal content for the predominating sugar and the elimination of the latter from the diet. He did not consider swallowed purulent nasal secretion as a very likely factor in intestinal toxemia.

Dr. Judson Deland (closing) stressed the better results following the removal of a single focus than when multiple ones must be eradicated. In either case only complete removal will be satisfactory, and the sooner it is done as a prophylactic measure the better.

DR. PERRY GOLDSMITH (closing) recommended a closer cooperation between internists and laryngologists in the treatment of all these patients.

ABLATION EXPERIMENTS ON THE LABYRINTH OF FROGS. Presented by DR. JOHN TAIT, Montreal.

In a most interesting address and demonstration, the speaker described his work on the frog's labyrinth. He has found that destruction of the saccular macula produces no demonstrable effect on the animal's equilibrium, whereas destruction of the utricular macula deprives it of all sense of its relation to gravity, proving this portion of the labyrinth to be a strictly static organ concerned with change in position about a horizontal axis. This point was illustrated by frogs in which the utricular macula had been destroyed, in comparison with normal frogs.

The semicircular canals, on the other hand, are concerned with active motion of the head in the various planes in which they lie. These are divided into horizontal and vertical, the latter being so placed that each canal points toward one of the four limbs. Rotation of a normal animal about a horizontal axis results in supportive limb movements in the opposite direction, a reaction which is absent if both horizontal canals are destroyed. If one remains, the reaction takes place or not according to the direction of rotation. In a normal animal rotation in the plane of any one of the four vertical canals results in a supportive movement of the corresponding limb, an effect which does not occur if the canal relating to this limb is destroyed. Thus, rotation toward the right posterior canal normally produces an extension of the right hind leg, toward the left anterior canal, of the left fore leg, etc., effects absent following destruction of these canals.

The speaker suggested that these results might be usefully applied clinically in testing equilibrium of patients, and demonstrated a tilting board with which, with patient on hands and knees, the individual vertical canals could be quickly stimulated and the effect on each of the four limbs noted.

COOPERATION OR INTERFERENCE OF REFLEXES FROM OTHER SENSE ORGANS WITH THOSE EVOKED FROM THE LABYRINTHS. Presented by PROF. R. MAGNUS, Utrecht, Holland.

In a scholarly address the speaker described his work on labyrinthine reflexes exclusive of those resulting from movements of the semicircular canals. Any change in the position of an animal's head in space, by virtue of stimulation of the static labyrinth, produces certain characteristic attitudinal poses appropriate to the purpose of the animal. In a similar way, by exclusion of the labyrinths by decerebration, limb reflexes are found to arise from certain positions of the neck (neck reflexes) which can be eliminated by cutting the cervical roots or fixing the neck in plaster. In a cerebrate animal these can be brought out independent of the labyrinth by fixing the head and moving the body.

In a similar manner, eye reflexes result from stimuli arising from the static labyrinth and from the neck which supplement each other, and which maintain the eyes in the same position that they would attain during a corresponding canal stimulation.

Third, the characteristic tendency of any animal to "right" itself in space results from the summation of several sets of stimuli which can be shown independently to produce this complex reflex. Thus the labyrinth (static), tonic neck reflexes, an asymmetrical pressure on the surface of the body

affecting both the position of the body and the head, and in higher animals eye reflexes, all combine to "right" an animal in space. The classical example of the result of the loss of all these is that of a blind deaf mute in water, who thereby loses all sense of righting.

The address was illustrated by lantern slides, and the demonstration of various points by laboratory animals.

OTOSCLEROSIS. CANDIDATE'S THESIS READ BY TITLE. Presented by DR. DANA DRURY, Boston.

The author first recounts progressive investigations of previous workers which have lead to our present conception of otosclerosis and its fundamental bony pathology. Details of this concerning the absorption of old bone and the deposition of new in such a way as to cause stapes fixation, are discussed. Heredity is a factor of prime importance in this disease, which is not to be confused with congenital deafness such as that due to syphilis. It is more common in the female and is influenced by such factors as childbirth, menstrual disorders and prolonged lactation. The determinants leading to otosclerosis are inborn and first appear, according to the author, at a time such as puberty, when cellular changes are taking place throughout the body.

The diagnosis is at times difficult when complicated by a coexisting adhesive middle ear condition and no tests are specific, but typical cases can readily be detected, especially those with a hereditary tendency.

The author next outlines the relationship of the endocrine system to otosclerosis, so far as it concerns the thyroid, parathyroids, pituitary and the ovaries, and reports the favorable results of some experimenters in administering extracts for the cure of this disease. In 100 of his own cases, however, one third of them showed absolutely no endocrine disturbance, and he concludes that this influence is indirect and nonspecific. Endocrine dysfunction exerts its effect by adding one more abnormal factor to an already unstable condition, and one capable of upset on the slightest provocation.

In an exhaustive comparison of a complete physical, chemical, and metabolic examination of two deaf brothers, both with an otosclerotic inheritance, the writer brings out the fact that one of the patients shows no endocrine disturbance while the other is distinctly of the pituitary type, with other abnormalities appearing besides the deafness, the latter being influenced but not caused by a deranged metabolism.

In conclusion, it appears that in a hereditarily predisposed person chemical changes affecting bone and cartilage growth may be brought about by endocrine or other dysfunctions causing an abnormal metabolism, with otosclerosis as the result. Glandular treatment may be of some use in endocrine cases, in which ankylosis of the stapes has not progressed too far.